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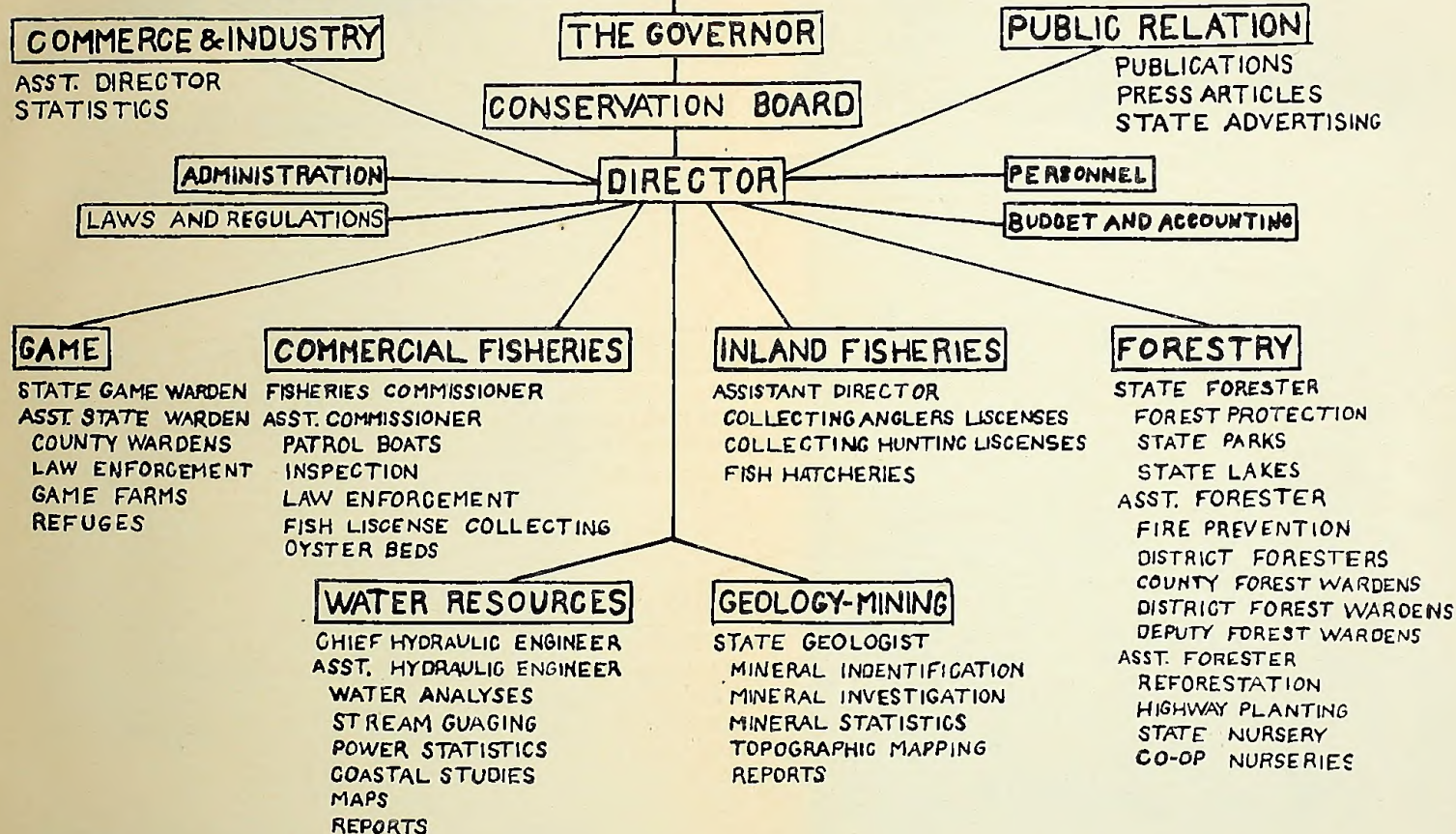


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CONSERVATION AND DEVELOPMENT

OF

RESOURCES AND INDUSTRIES OF NORTH CAROLINA



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SECOND BIENNIAL REPORT
OF
The Department of Conservation
and Development
OF THE
STATE OF NORTH CAROLINA

FOR THE BIENNIUM ENDING JUNE 30, 1928

BOARD OF CONSERVATION AND DEVELOPMENT

Governor A. W. McLean, Chairman.....	Raleigh
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E. D. Cranford.....	Asheboro
Geo. L. Hampton.....	Canton

Wade H. Phillips, Director..... Raleigh

LETTER OF TRANSMITTAL

Raleigh, N. C.,
November 23, 1928

To His Excellency, HON. A. W. McLEAN,
Governor of North Carolina.
Sir:

Complying with Section 11, Chapter 122, Public Laws of 1925, I have, by direction of the Board, prepared and submit herewith to you for the General Assembly a report showing the nature and progress of the work done by the North Carolina Department of Conservation and Development, together with a statement of expenditures of the Department for the biennium ending June 30, 1928.

Very respectfully submitted,
WADE H. PHILLIPS,
Director

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PREFACE

This Department was created by the General Assembly of 1925 (Public Laws of 1925, Chapter 122). A part of the new Department's function was to take over the work heretofore done by the Geological and Economic Survey. In addition, the Department of Conservation and Development was given broader powers in regard to the conservation and development of the State's resources. The new act emphasizes as much as ever the importance of forestry, water resources and geology. It is also provided that the Department shall be a publicity bureau to advertise the State. It is required to gather and collate fundamental facts on the State's industrial and natural resources, to collect and publish from time to time statistics showing the growth of the State and its economic advantages.

The General Assembly of 1927 enacted the North Carolina Game Law (Chapter 51, Public Laws) and at the same session consolidated the State Game Commission with the Department of Conservation and Development (Chapter 250, Public Laws). At the same time the Fisheries Commission and the Department of Conservation and Development were consolidated (Chapter 51, Public Laws).

Thus were united in the interest of economy and efficiency these important State agencies for the conservation of our natural resources.

Our supply of inland fish and game is dependent on the preservation of our forests. Many benefits have already resulted from a single administration of our laws pertaining to these natural resources. The public has a better understanding of the need for conservation. The coöperation obtained by combining these agencies has resulted in economy in expenditures. But an even more important result has been obtained by those engaged in each branch of the work, giving active aid with a full appreciation of the value of our other resources. The Department has also sought to impress the public with the fact that our resources are inter-dependent.

12+121

ADMINISTRATIVE DIVISION

WADE H. PHILLIPS, *Director*

STAFF

ETOYAL PARKER, *Fiscal Clerk*

GLADYS PRITCHETT, *Purchasing Officer*

MRS. ELSIE P. DUNN, *Accountant*

MRS. CARITA WADE MOORE, *Stenographer*

Nature has endowed our nation with such wealth of natural resources that our people in the past have always made heavy drafts on these stores with little thought of the future. North Carolina still has a wealth of woods, untouched minerals and non-metallic clays, a variety of waters for industry and health and an abundance of wild life in her fields and forests. Hunting and fishing is till recognized by a large part of our population as the leading sport and recreation.

True conservation consists in the wise use of these resources. It is the duty of the State, and our laws so provide, to so regulate the use of these resources that they be preserved not only for present use but for the enjoyment of future generations. The labor of the conservationist is toward an ideal. His work does not take effect at once, but is a gradual process over a number of years. Conservation must, therefore, be based on public education as to the value and importance of preserving for others what God has so graciously committed to us. The condition of our State, its progress, and the health and happiness of our people twenty-five years from now will depend to a large degree on how we use our natural resources. The State owes a duty to its future citizens to safeguard the heritage of natural wealth that the blessings thereof shall not be denied to those who come after us.

It is in this spirit that our lawmakers have provided rules by which our citizens have the opportunity to enjoy our out-of-doors with equal rights to all and special privileges to none. It is in the same spirit that the Board of Conservation and Development has made its program in order to put these laws into full force and effect.

The Board has likewise sought to carry on the work of gathering the facts of our resources and industries for the benefit of our people and to advertise our State abroad within the limit of the Department's facilities.

To these ends, the Director of the Department, the executive of the Board, has for the past two years devoted his time to supervising the work of the Department. He has sought constantly, by daily contact with the other employees, to assist, to advise, and to coördinate the work of the various divisions. He has endeavored, by keeping in touch with the public and coöperating with other State departments and agencies, to carry out the policies adopted by the Board.

DIGEST OF THE TWO YEARS' WORK BY DIVISIONS

Division of Forestry

Maintained and developed a loyal and efficient technical, clerical and field personnel.

Established a fifth forest protective district with headquarters at Windsor.

Established the position of chief forest warden as Assistant to the District Forester and appointed four, by promoting selected county forest wardens.

Received financial coöperation from the Federal Government under the Clarke-McNary law amounting to \$75,000 for forest fire prevention and \$4,000 for distribution of tree seedlings for forest planting.

Secured a total of \$36,200 in financial coöperation from thirty-five counties to pay for half the cost of forest fire prevention and control in these counties.

Received a total of \$7,860 from private landowners through loosely organized forest protective associations for additional protection of their lands.

Erected three wooden and five steel lookout towers chiefly through county and private coöperation.

Constructed 110 miles of telephone line connecting lookout towers with the field personnel.

Developed a field force in the coöperating counties totaling some 5,000 men. Instructed and supervised them in their work of forest protection. Fire fighting equipment has been purchased and placed in care of these men for emergency use.

Through education, publicity and law enforcement the size of the average fire has been reduced to 122 acres.

Reforestation of denuded areas has been encouraged by the distribution to farmers of 215,000 forest tree seedlings at a cost to them of \$3.00 per thousand.

A new forest nursery site of $9\frac{1}{4}$ acres near Raleigh has been purchased and a packing shed and tool house built upon it. A watering system for this nursery has been installed with a deep well, power pump, and pressure tank.

Forest tree seedlings have been distributed to 27 schools with instructions for demonstrations in forest planting. Some 20,000 young trees have been planted on the two State parks in a program of reforestation.

A stone tower has been built on the summit of Mt. Mitchell and subsequently reinforced by lining of steel concrete, the gift of Col. C. J. Harris, of Dillsboro, North Carolina.

A rough masonry monument has been placed on the grave of Dr. Elisha Mitchell, a wrought iron fence placed around it and a memorial tablet placed upon it; the principal cost paid by private subscription.

A new park warden's cabin has been erected on Mt. Mitchell State Park at a cost of some \$2,800, providing a suitable home for the warden and shelter for parties when needed.

A part-time park warden has been employed to look after Fort Macon State Park.

Three of the State lakes, namely Waccamaw, Singletary and White Lakes, have been placed under partial administration. Part-time wardens have been employed and protection for the fish during the breeding season inaugurated.

A permit system for the construction and maintenance of docks and the use of boats has been begun.

A much needed survey of the State-owned lakes has been begun with the boundary survey of White lake, the field work of which was done by the Water Resources Division.

The Waccamaw lake dam constructed by legislative enactment was repaired by county and private funds under State supervision.

The promised gift by Judge T. B. Finley of 140 acres of woodland including Rendezvous mountain in Wilkes county was consummated.

Information on forestry and the State's timber resources, both printed and by letter, was distributed to teachers, school children, women's clubs, and hundreds of other organizations and individuals.

Coöperation with North Carolina State College in giving a short forestry course in the college was continued during the winter and spring of 1927.

A field study of the forest conditions of the Durham City Watershed was begun in coöperation with the Water Resources Division which is carrying on stream gaging and silting investigations.

A study of non-utilized wood in the industries of the State has been begun in coöperation with the U. S. Department of Commerce.

A State-wide investigation of the timber resources of the various counties has been started through special agents employed for this purpose.

The "Forest Warden", a quarterly publication, has been issued; and circulars, addresses, special articles and other publicity prepared and distributed.

Division of Game

The new North Carolina Game Law went into effect June 1, 1927.

During the first year of operation of the new law, the Director of the Department served as State Game Warden.

Game license sales were handled by Assistant Director J. K. Dixon.

Total sales of hunting licenses for the first year's operation of the law numbered more than 138,599, and the receipts amounted to more than \$204,000. Original estimates were only between \$75,000 and \$100,000.

Arrests for violations by Game Wardens during the first year amounted to 875.

A system of game refuges was started during the year, and the State system now includes some 70,400 acres, which, together with the Federal Pisgah Refuge, makes a total of 170,400 acres of refuge lands under public administration in North Carolina.

A farm stocked with approximately 250 deer has been obtained by the Department under lease from J. E. Bureson of Spruce Pine. The farm consists of approximately 400 acres. The annual increase in the herd will be used in stocking various public refuges in the State.

A tabulation shows 66 private game preserves in this State, containing more than half a million acres.

Approximately 200,000 acres of additional lands have been offered under lease to the Department for the establishment of refuges. Surveys are being made of these areas as rapidly as possible in order to help build up a more comprehensive system of refuges well distributed over the State.

A State Game Farm was established near Asheboro. It is estimated that around 1000 quail will be reared at the farm the first year and approximately 350 pheasants. Besides the birds that will be raised at the farm, several hundred pheasant eggs have been distributed to sportsmen.

By order of the Board, \$8,000 was spent in the purchase of 4,000 Mexican quail in the spring of 1928. These birds were distributed to all counties of the State and released in suitable covers for restocking.

An appropriation of \$10,000 to be paid in bounties for the destruction of crows, hawks and wildcats, enemies to other game and to the farmer, has been recommended for the second year of the operation of the law.

In order to obtain information regarding the amount of game in the State, its distribution, and for the solution of game problems, a census of game killed

the first season was taken. On the basis of returns from approximately 40 per cent of the hunters, it is estimated that the value of flesh and furs of birds and animals killed annually in the State amounts to approximately \$1,539,376. The total estimated kill of birds and animals for the year was 4,529,590.

By means of a continuous program of public education, the interest in the wild life of the State among the citizens is being increased. Talks by game officials, articles in the press, radio, special publications, motion pictures, and "Conservation and Industry", Departmental publication, are being used to promote the interests of wild life.

Special attention is being paid to song birds, birds of plumage, and insectivorous birds by Department officials. Wardens have been instructed to protect this class of wild life to the fullest extent provided under the law.

The warden organization in the State will be completely reorganized and full-time wardens are to be employed. Instructions have been given for a more strict enforcement of the laws which will result in effective conservation of wild life.

Division of Commercial Fisheries

Output of food fishes for biennium reported at 46,159,610 pounds, with a valuation of \$3,124,155, in comparison with 32,000,000 pounds for the previous biennium.

Oyster production amounted to 598,209 bushels for the biennium.

Shrimp production during the report period increased by 73,364 pounds in volume and \$11,000 in value, the total yield being 953,956 pounds.

Total of 329,679,000 menhaden caught. Sold by fishermen for \$659,358. Previous biennium recorded a catch of 300,200,000 of the fishes, bringing a return of \$451,000 to fishermen.

The yield of clams for the biennium was 45,524 bushels, valued at \$91,250.

Fishermen reported to the Commissioner the taking of 165,000 gallons of escallops, which sold at an average price of \$2.00 per gallon.

The major operation of the Commercial Fisheries Division was in patrolling commercial fishing waters and the enforcement of regulations for the protection of the industry. Six patrol boats were used in these operations.

A considerable amount of time and study devoted by the Commissioner and his staff in determining regulations necessary for the conservation of commercial fish and the maintenance of the supply.

In coöperation with the State Board of Health and the U. S. Public Health Service, the Division has maintained a sanitary supervision over the shellfish industry for the protection of the public and the industry.

Surveys of oyster and shellfish producing grounds to determine the condition of the beds and of non-producing grounds which may be capable of growing oysters have been made with the coöperation of the U. S. Bureau of Fisheries.

The Division has had in charge the leasing of State-owned bottom lands to individuals for "oyster gardening". This industry is being promoted by the Division.

The Division, in coöperation with the U. S. Bureau of Fisheries, has operated a terrapin farm at Beaufort. In October, 1927, 6,304 young terrapins had been removed from egg beds. It is expected that about 10,000 of the animals will be hatched in 1928, and that by 1930 the annual hatch will be between 25,000 and 30,000 terrapins. The operation of this farm and a closed season on the

terrapin were launched to revive a profitable industry that had almost died out because of the scarcity of the terrapins.

The patrol boat, "Capt. John A. Nelson", was purchased from an appropriation of \$25,000 by the General Assembly of 1927. This vessel takes place of the "Atlantic" which had been in service for more than a quarter of a century.

This Division has also been active in promoting the further development of the commercial fisheries operations of the State. One of the principal features of this work has been efforts to extend the market for North Carolina sea products. This has been forwarded by the preparation and broadcasting of statistics showing the scope and importance of the commercial fisheries, and urging North Carolinians and outsiders to call for sea products from this State.

Division of Inland Fisheries

Water of the State have been classified as "Inland" and "Commercial" for the purpose of convenience and administration, making regulations more simple and understandable for the public.

The first State Anglers' license law has been administered by the Division. Collections from anglers' licenses through the fiscal year ending June 30, 1927, amounted to \$10,750 and for the year ending June 30, 1928, were \$16,605.

During the past year, \$6,806 has been spent in making additions and improvements at the various hatcheries. A total of five old hatcheries, one new hatchery, and two in coöperation with the U. S. Bureau of Fisheries have been operated by the Division; two of these, however, only during the last year of the biennium.

Anglers' license act allowed requirement for license to be extended to all types of fishing in mountain trout streams. At the solicitation of this Division, all of these counties, with the exception of Henderson, have adopted this provision through action of the county commissioners.

A new hatchery was established during the year ending June, 1928, at Lake James, Burke county, from funds received through revenue collections from operation of the Burke-McDowell local act. Administration of this act was turned over to this Department by the special commission appointed for its enforcement.

In coöperation with the U. S. Bureau of Fisheries, the old striped bass (rock) hatchery at Weldon was reestablished. The Federal Bureau took up the proposition at the solicitation of this Division.

Probably the outstanding accomplishment of this Division during the biennium has been in arousing public interest in the construction of nursery or rearing ponds for baby fish from the State hatcheries.

Approximately 400,000 fry have been reared to the fingerling size before liberation in streams of the State. This has greatly increased the efficiency of the game fish restocking program, and will doubtless be reflected in vastly improved fishing next season. Approximately 25 of these nursery ponds have been constructed, mostly by organizations of sportsmen, donations from counties and municipalities, and by individuals. Most of the fingerlings released from the nursery ponds will survive while a great majority of those turned out at the fry age perish through natural causes and at the hands of their enemies.

The total distribution of fish from the hatcheries amounted to 1,775,929 in 1927 and increased to 10,254,542 in 1928, 7,230,750 of these being striped bass from the Weldon hatchery.

A tentative arrangement has been made with H. C. Marmon, president of the Marmon Car Company, for rearing 100,000 trout fry at his private hatchery on Linville River, near Pineola, Avery county, at his expense, and turning 50 per cent back to the Department for distribution in other sections of Avery county.

Division of Water Resources and Engineering

Total of 39 gaging stations in operation increased to 50. By end of 1928 it is contemplated that 64 stations will be in operation, representing greatest number ever operated in North Carolina and a larger number than in any other Southern State.

Power statistics for 1926 and 1927 were prepared and published in "Conservation and Industry" and in daily newspapers of the State.

Data collected on rural power and efforts made to stimulate interest in its development.

Studies of evaporation made at stations on Lakes Tallassee and Michie and at land station at Chapel Hill.

Detailed study of stream flow, rainfall, evaporation and silting in coöperation with city of Durham, with Forestry Division undertaking a correlated study of vegetation on watershed.

Exhaustive study of back-water conditions above new bridge over Tar River at Greenville made for State Highway Commission. Report led to setting aside of an injunction instituted against Commission and a saving of \$40,000 by finding a solution of flood problems without necessitating the lengthening of the bridge.

Investigations of physical changes taking place along the beaches of the State were started; base lines run and tied in with the triangulation system of the U. S. Coast and Geodetic Survey.

The State Stream Sanitation and Conservation Committee was formed in conjunction with the State Board of Health. Committee is working towards solution of stream pollution problems. Committee made report on stream pollution in Roanoke River at Weldon in connection with the reëstablishment of the rock hatchery at that point. It was found that the situation was materially improved and the hatchery was operated last year.

Stream Sanitation and Conservation Committee has affected an agreement with paper mills of State for a joint investigation to determine means of reducing injurious effects of wastes. First study was begun under agreement on Pigeon River at and below Canton. Sanitary surveys begun on Neuse, Haw, Catawba and Tar rivers.

Chemical analyses have been made of samples of 181 industrial waters in the State, through arrangements with other agencies, to determine their suitability for use in industrial processes. These were compiled and printed with other data including rainfall distribution, location of stream gaging stations, and temperature distribution.

Active assistance has been given by the Division in the development of municipal airports.

Manuscript reports on water powers of the Hiawassee, New, Watauga, and Dan Rivers completed and ready for publication. Pamphlets, maps, and other publications issued were:

"Distribution of Annual Rainfall and Rainfall in North Carolina".

"Preliminary Report on Industrial Waters of North Carolina", Economic Paper 61.

Maps of White Lake and Fort Macon.

Power map of North Carolina, showing Transmission Lines and Power Plants.

"Power Situation in North Carolina, 1925," Circular 16.

Division of Mineral Resources

Total of 660 specimens of minerals received by the State Geologist from residents of State and reports made thereon.

Marl deposits along Trent River, in Jones County, investigated. A \$3,000,000 Portland Cement plant is under consideration for this location.

Feldspars in Yancey County investigated, leading to the establishment of \$350,000 plant, now almost ready for operation.

Preliminary surveys of amphibole asbestos deposits. Two plants have been established and two others under construction.

Survey made of white ware industries of the State of Ohio, West Virginia and Pennsylvania in an effort to interest manufacturers in North Carolina. Thought probable that one or more may locate plant in State.

Preliminary report on gold and copper deposits in Randolph, Rowan and Halifax Counties. Report being followed by a more thorough investigation by engineers with some prospect that development may be started.

In coöperation with Dr. J. L. Stuckey, Professor of Geology at State College, brief survey of mica, feldspar, and kaolin industries was made. Survey showed condition of industries to be good. Three new feldspar plants, five mica recovery plants, and one mica grinding plant, and new machinery installed in two clay washing plants during biennium.

With Dr. A. F. Greaves-Walker, Professor of Ceramic Engineering of State College, survey made of principal brick and tile producing centers of State. One new plant near Hendersonville is producing buff-face brick, and new tile plant opened near Winston-Salem.

Furnished information on pyrophyllite deposits of Moore County and made personal inspections. Following preliminary report, new plant constructed near Glendon. Another is being considered at Staley, Randolph County.

Reports on marble deposits in Cherokee County. Plant now being constructed near Marble, N. C., costing close to \$200,000, for production of building stone, terrazzo material, crushed stone, lime, and possibly other materials.

Mineral deposits have been catalogued by counties, several trips being necessary through mineral zones for the purpose of checking the chief deposits. This information to be part of general survey of natural resources to be published by the Department. Publications issued are as follows:

Economic Paper No. 58, "Oil-Prospecting Well near Havelock, North Carolina", by Wendell C. Mansfield.

Economic Paper No. 59, "Oil-Bearing Shales of Deep River Valley", by Dr. Frank C. Vilbrandt.

Economic Paper No. 60, "The Mineral Industry in North Carolina During 1924-1925".

Economic Paper No. 62, "The Mineral Industry in North Carolina During 1926".

Educational Series No. 1, "The Story of the Geologic Making of North Carolina".

Bulletin No. 37, "The Pyrophyllite Deposits of North Carolina", by Dr. J. L. Stuckey.

Division of Commerce and Industry

Took biennial Census of Manufacturers for 1927 in coöperation with the U. S. Bureau of the Census, requiring the time and efforts of a large staff of workers for several months. North Carolina is one of only two States undertaking this work. Statistics have been made available and are being used months in advance of time they would have been obtainable otherwise.

For the first time, statistical data on industry have been tabulated for county units and made available for use of Chambers of Commerce and other booster organizations.

This Division has been designated as a coöperative office of the U. S. Bureau of Foreign and Domestic Commerce, and has served both industry and commerce in promoting trade and markets. Some 75 North Carolina firms have been added to the bureau list to receive literature and suggestions in the development of commerce and industry.

The Division has functioned, as far as possible with limited personnel, in the nature of a State Chamber of Commerce. One of its services in this line has been in providing reliable facts and figures to inquirers interested in industrial locations, and general information to trade bodies, universities, and other agencies in interest of development within the State.

A preliminary survey of industries and natural resources of North Carolina has been made. The object of this study is to determine the extent to which the natural resources have been exploited and the opportunities for further development. It is intended as the beginning of a fundamental work to point out in broad terms existing conditions for the guidance of trade bodies in promoting the growth of their communities and the State at large. The survey will include inventories of forest, mineral, power, fisheries, wild life, labor, climate, transportation and communication resources of North Carolina.

Promotion of industrial enterprises in the State has been emphasized by assistance to local booster organizations and by direct contact with manufacturers. Services were performed in connection with the landing of two large rayon plants for North Carolina. Both projects were materially aided by efforts of this Division.

Special studies have been conducted in the industrial field to determine in which branches there is greater promise of development in this State. One of the most important of these is a study of the textile industry, showing fields that are already covered and those in which development is open and logical for the future.

The Division also gathers statistics for all State agencies, turning these figures into channels for the promotion of the best interests of the State. Publications are as follows:

"Facts and Figures" for 1927 and 1928.

"Analysis of North Carolina Taxes and Debts; What They Are and What They Have Bought".

"North Carolina Industrial Directory".

"North Carolina—A Good Place to Live", with the coöperation of the Division of Public Relations.

"North Carolina Resources and Industries", in process of completion. A general survey of industrial development and resources available for exploitation in interest of progress of the State.

Division of Public Relations

Approximately 573 articles have been prepared for the press of this State and for distribution through national news agencies.

Forty-one issues of the Departmental publication, "Conservation and Industry", have been printed in bi-monthly numbers. This involved the preparation of some 984 sheets of copy paper.

Title of publication changed from "Natural Resources" to its present name. Circulation list has been completely revised with approximately 500 names that were considered ineffective dropped and new ones added until the mailing list at present consists of about 5,000 compared with approximately 2,800 at the beginning of the biennium. The size of the publication has been increased from a four-sheet folder to a booklet with an average of 14 pages.

A program of advertising the hunting facilities of the State and involving the expenditure of between \$1,000 and \$1,500 is being carried out. This program is being followed up by the preparation and distribution of reading matter which will be run as free material.

A limited amount of paid promotional advertising of the State has been carried on in such publications as the "Blue Book of Southern Progress", "National Investor", and other publications.

Hundreds of photographs of scenes in the State have been obtained and used by this and other Divisions in State publications and distributed to nationally circulated magazines and newspapers for advertising purposes.

Articles for State advertising purposes have been furnished to such publications as "Manufacturers Record", "Electrical America", "Electrical South", "Stone", "Black Diamond", "American Mining Congress Journal", "Southern Fish and Oyster Reporter", "Field and Stream", "Outdoor America", "National Sportsmen", "Southern Lumberman", "New York Times", "Christian Science Monitor", and numerous others. The subjects of these articles covered all phases of activities of the Department.

Division has arranged a number of broadcasting programs for the purpose of advertising the State and furthering the program of conservation and development. It coöperated with the Forestry Division in putting on a series of addresses during American Forest Week and also is assisting in "North Carolina Week" program over a Nashville, Tenn., station. Arrangements have been made for a continuous series of broadcasts over WPTF, Raleigh, and other North Carolina Stations.

Bulletin No. 35, "Fishing in North Carolina", a compendium of statistics and reading materials to advertise this resource and to promote its conservation and development.

Bulletin No. 36, "Hunting in North Carolina", for the same purpose.

Work was started on "Where to Go and What to See in North Carolina", intended to advertise tourist attractions, to exploit recreational facilities, and to promote a better knowledge of the resources of the State.

ADMINISTRATIVE DIVISION RECEIPTS AND DISBURSEMENTS

(Including Divisions of Commerce and Industry and Public Relations)

BIENNIAL PERIOD ENDING JUNE 30, 1928

RECEIPTS

State Appropriation.....	\$ 37,154.57	
State Appropriation allotted for Sesqui-centennial Exposition.....	1,768.41	
Contributions from other State Departments for participation in Sesqui-centennial Exposition.....	4,637.73	
Sale of Publications.....	201.47	
Private Coöperation—Commercial Fisheries.....	325.00	
Refunds.....	17.50	
Miscellaneous.....	91.12	
		<hr/>
Total Receipts.....	\$ 44,195.80	

DISBURSEMENTS

Personal Services—Professional and Clerical.....	\$ 20,960.23	
Supplies and Materials.....	919.20	
Postage, Telephone, Telegrams and Express.....	3,310.77	
Travel Expenses.....	3,354.15	
Printing—Reports, bulletins, stationery, etc.....	4,315.51	
Lights.....	6.70	
Repairs to Equipment.....	73.62	
General Expenses.....	123.09	
Equipment.....	937.22	
Sesqui-centennial Exposition.....	6,579.14	
		<hr/>
Total Disbursements.....	\$ 40,579.63	
		<hr/>
Balance on Hand.....	\$ 3,616.17	

DIVISION OF FORESTRY

J. S. HOLMES, *State Forester.*

FORESTRY DIVISION PERSONNEL

State Forester	J. S. HOLMES	
Assistant State Forester	W. C. McCORMICK	Resigned June, 1928
Assistant Forester	F. H. CLARIDGE	
District Forester	CHAS. H. FLORY	
District Forester	HAROLD M. SEBRING	Resigned June, 1928
District Forester	K. E. KIMBALL	Resigned Jan., 1927
District Forester	R. G. WHEATON	Appointed May, 1926
		Resigned Aug., 1927
District Forester	F. HENRY SIPE	Appointed April, 1927
		Resigned June, 1928
District Forester	W. K. BEICHLER	Appointed July, 1927
District Forester	LINTON A. CARTER	Appointed Aug., 1927
District Forester	E. M. EUTSLER	Appointed June, 1928
Sr. Acct. Clerk Steenog.	GRACE WHITE	
Junior Stenographer	ELSIE HOBBY	
Junior Stenographer	MRS. ALICE BRADLEY	Appointed June, 1927

FOREST FIRE PREVENTION

The policy of confining the activities of the Department in actual forest protection to counties which contribute financial coöperation has been continued. Instead of making special efforts to secure additional counties Mr. McCormick has bent every effort to intensify protection and make the work more effective in the counties already under contract.

On July 1, 1927, four Chief Forest Wardens were appointed by promotion from the ranks of the County Forest Wardens in Districts 1, 2, 3 and 4. These men act as assistants to the District Foresters; they have increased tremendously the supervision of the field force and the effectiveness of the work of fire control in general. The Chief Warden in District 4, has divided his time with District 5, but a new Chief Warden will shortly be appointed in the latter district.

The increasing volume of work made it necessary in the spring of 1927 to employ a Clerk-Stenographer on full time in each of the district offices instead of part time work as formerly. They carry on the complete routine work of the District offices which permits the District Foresters to spend the major portion of their time in the field.

Coöperation. While the State appropriation for the forest fire prevention work was increased twenty-four per cent over the previous biennium, the receipts from coöperating agencies increased 67 per cent. The amount allotted under the State budget for 1926-27 was \$16,990 and for the following year \$28,110.

Under Section 2 of the Clarke-McNary law, the Department secured financial assistance from the Federal government in forest fire prevention. For the 1926-27 fiscal year, the Federal allotment was \$34,000 and for the 1927-28 fiscal year \$41,438. This is among the largest of the allotments to any State.

County coöperation increased from twenty-nine counties during the first fiscal year to thirty-three counties in the second year of the period. A considerably larger increase, however, was made in the total county appropriations. Few counties allotted less than \$500 and a number of counties allotted \$1,000 or more. In several instances other counties wanted to coöperate but with amounts less than that which was deemed advisable to carry on the work and no agreement was affected. The fact that these county allotments have made such a large increase during the biennium is proof of the increased interest on the part of the taxpayers of these counties in forest fire control.

COUNTIES COÖPERATING AND ANNUAL SUMS MADE AVAILABLE BY THEM FROM
1922 to JUNE 30, 1928, INCLUSIVE

County	1922 Amount	1923 Amount	1924 Amount	1925 Amount	1926 Amount	1927 Amount	1928 Amount
1. Avery.....	\$ 150	\$ 150	\$ 150	\$ 300	\$ 300	\$ 300	\$ 300
2. Beaufort.....	250	250	250	250	250	.....	.....
3. Bertie.....	.....	.....	.....	.....	.....	.....	800
4. Bladen.....	.....	.....	.....	.....	500	500	.....
5. Brunswick.....	.....	.....	.....	.....	.....	200	1,000
6. Buncombe.....	1,000	1,000	1,000	1,000	1,000	1,000	1,000
7. Burke.....	.....	100	100	200	300	350	350
8. Caldwell.....	.....	200	200	450	450	450	650
9. Cherokee.....	100	150	150	.....	.....	.....	.....
10. Clay.....	200	125	250	.....	.....	.....	.....
11. Columbus.....	150	200	200	500*	500	500	.....
12. Cumberland.....	300	300	300	300	300	300	750
13. Craven.....	.....	750	750	650	650	1,300	1,000
14. Duplin.....	.....	.....	.....	500	2,500	2,500	1,200
15. Greene.....	.....	.....	.....	.....	.....	.....	500
16. Harnett.....	.....	300	300	500	500	500	500
17. Haywood.....	250	300	300	400	400	700	400
18. Henderson.....	.....	200	200	200	200	300	300
19. Hertford.....	.....	.....	.....	.....	.....	.....	500
20. Jackson.....	200	.....	.....	.....	.....	.....	500
21. Jones.....	.....	.....	.....	400	400	718	.....
22. Lenoir.....	.....	.....	.....	500	500	500	600
23. Macon.....	.....	.....	.....	500	500	500	400
24. Madison.....	.....	400	400	400	400	500	500
25. McDowell.....	300	400	400	650	500	800	500
26. Mitchell.....	.....	.....	300	300	300	.....	.....
27. Moore.....	.....	.....	.....	500	500	500	750
28. New Hanover.....	200	150	150	500	.....	.....	270*
29. Onslow.....	.....	.....	.....	.....	500	.....	.....
30. Pamlico.....	200	200	200	.....	.....	.....	.....
31. Pender.....	.....	400	400	.....	.....	.....	.....
32. Pitt.....	.....	.....	.....	500	500	500	500
33. Polk.....	.....	150	200	200	200	300	300
34. Robeson.....	.....	800	800	800	800	800	1,200
35. Rutherford.....	.....	.....	600	600	600	600	600
36. Sampson.....	.....	200	200	200	.....	.....	.....
37. Surry.....	.....	.....	.....	.....	500	500	500
38. Scotland.....	.....	.....	.....	.....	.....	.....	500
39. Swain.....	.....	300	300	300	300	300	250*
40. Transylvania.....	300	300	300	300	300	400	400
41. Watauga.....	250	.....	.....	100	100	100	.....
42. Wayne.....	.....	.....	.....	.....	.....	.....	500*
43. Wilkes.....	500	500	500	500	500	500	500
44. Wilson.....	.....	.....	300	.....	.....	.....	500
45. Yancey.....	.....	.....	.....	300	300	300	300

*Coöperated part year.

Fifty-two corporations, firms and individuals, embraced in eight forest protective associations, had their holdings listed on the basis of 1c and 2c per acre, the total amounting to \$5,450 at the close of the biennium. Private coöperators' funds increased more than four and one-half times during the first fiscal year and they more than doubled the next fiscal year.

Plans and estimates were drawn up in the fall of 1926 in coöperation with the Virginia Forest Service to protect 180,000 acres of forest land in the Dismal Swamp, 80,000 acres of which is in North Carolina. While this project was temporarily abandoned, it will undoubtedly be perfected in the coming biennium.

The rapid increase in private coöperation throughout the State has assisted materially in intensifying the work of forest fire control.

FOREST PROTECTIVE ASSOCIATIONS COÖPERATING WITH THE STATE FOREST SERVICE JUNE, 1928

Name	Counties	Individuals	Acreage
South Mountain Ass'n	Burke, Rutherford, McDowell	Hutton-Bourbonnais.....	15,735
		C. M. Benedict.....	470
		Sanders Heirs.....	150
		Virginia Grayson.....	407
		Mrs. T. J. Perkins.....	1,500
		E. A. Martin.....	950
		Spainhour and Mull.....	500
		N. C. School for the Deaf.....	513
		So. Mountain Development Co.....	1,100
		Realty Loan and Guaranty Co.....	2,150
		Town of Morganton.....	3,000
		Wright-Bachman Lbr. Co.....	20,000
		State Hospital Morganton.....	2,000
Overhills Prot. Ass'n.	Harnett	F. W. Hossfeld.....	1,400
		Never Fail Farm.....	5,000
		Overhills Land Co.....	30,000
		P. C. Lindley.....	1,340
Wilts Veneer Co.	Washington	Alex. Sprunt and Sons.....	6,000
		Wilts Veneer Co.....	3,300
Camp Mfg. Co.	Hertford, Gates, Bertie	Camp Mfg. Co.....	45,459
Craven Prot. Ass'n	Craven	Pine Lbr. Co.....	17,600
		Neuse Mfg. Co.....	835
		Empire Mfg. Co.....	4,973
Moore Prot. Ass'n	Moore	S. B. Chapin.....	800
		F. L. Fuller.....	400
		L. L. Biddle.....	111
		D. J. Ross.....	400
		Paul Dana.....	250
		M. C. McDonald.....	950
		Pinehurst Peach Co.....	550
		James Barker.....	2,000
		Mrs. E. C. Bliss.....	150
		H. C. Buchan.....	2,000
		Midland Farms, Inc.....	837
		Mid Pines Country Club.....	180

FOREST PROTECTIVE ASSOCIATIONS COÖPERATING WITH THE STATE FOREST
SERVICE JUNE, 1928—Continued

Name	Counties	Individuals	Acreage
		Pinehurst, Inc.....	5,705
		Pinewild Farm.....	1,750
		Spring Hill Farms, Inc.....	450
		Augustine Healy.....	180
		Sam Bostic.....	100
		Sweetheart Lake Corp.....	540
		Jas. L. Goodwin.....	300
		W. M. Blue.....	1,141
		B. F. Lowder.....	350
		Swoop and Newcomb.....	500
		Knollwood, Inc.....	4,017
		Pine Needles, Inc.....	531
		Frank Dugeon.....	211
Palestine Tower Coop. Area	Cumberland	McNair Investment Co.....	444
		Mrs. Franklin McNeil.....	1,495
		C. W. Weiss.....	1,058
Foreman-Blades Co.	Hertford	Foreman-Blades.....	23,819
		(Also contributed \$200 toward construction of lookout tower)	
Total acreage.....			215,601

A plan of coöperation was also worked up with the State Highway Commission. Maps were furnished the Highway officials showing the location of the forest wardens along State highways where forest fires are to be reported to the closest warden. This form of coöperation has worked exceptionally well and it is hoped that it can be continued with increasing effectiveness in the future.

At a conference held with officials of the Atlantic Coast Line Railroad in July, 1927, they agreed to pay the suppression cost of all forest fires for which their employees or operations were responsible. This marks the most advanced and constructive step taken by any railroad within the State. The plan has worked entirely successfully for the one year period during which it has operated. It is hoped that in the near future a similar form of coöperation can be worked out with all of the other railroad companies operating within the State.

With the bringing of the Game and Fisheries Divisions under the jurisdiction of this Department, coöperation with both of these in forest fire control work is wisely required. Under the Game law "the warden, deputy wardens, and refuge keepers are hereby made *ex officio* special forest wardens, and charged with the duty of reporting to forest wardens all infractions of the forest fire laws and to assist forest wardens in extinguishing forest fires and generally enforcing the laws and regulations for the preservation of the forests". At the same time "all forest wardens and park patrolmen" are made *ex officio* deputy game wardens. To further this coöperation, most of the County Forest Wardens will soon be appointed County Game and Fish Wardens. All of the Chief Forest Wardens carry on game and fish work amounting to an average of about eight days per month under the supervision of the District Foresters.

Progress in Protection. The following chart shows the progress made during the last four fiscal years, ending on the date designated:

PROGRESS CHART

	June 30, 1925	June 30 1926	June 30, 1927	June 30, 1928
District Foresters.....	4	4	5	5
Chief Forest Wardens.....			4	4
County Forest Wardens.....	20	33	25	32
District Forest Wardens.....	261	364	550	605
Deputy Forest Wardens	1,530	2,119	2,800	2,763
Minute Men.....				1,677
Total Forest Wardens and Minute Men....	1,815	2,520	3,384	5,086
Counties Coöperating.....	25	27	26	31
Private Timberland owners coöperating....	5	15	21	52
Forest land under State Protection.....	6,729,802	7,814,007	6,995,038	7,759,109
Appropriations by Counties.....	\$ 9,827	\$ 11,495	\$ 14,600	\$ 21,600
Appropriations by Private owners.....		500	2,410	5,450
Appropriated by State	18,682	17,470	16,990	28,110
Appropriated by Federal Government.....	19,875	29,465	34,000	41,438
Total Appropriation.....	\$ 48,384	\$ 58,930	\$ 68,000	\$ 96,598

The erection of ten lookout towers during the period marks the beginning of what should develop into a State-wide fire detection system. The steel towers range in height of from 35 feet to 102 feet, and were erected through county and private coöperation. Where accessible to the public, rest camps were provided at the tower sites and these have been extensively used by tourists and local visitors. The location of these lookout towers is as follows:

TOWERS ERECTED AND MANNED COÖPERATIVELY DURING THE PERIOD JULY 1,
1926-JUNE 30, 1928

Kind	Height	County	Locality
Stone	24 feet	Yancey.....	Mt. Mitchell State Park
Wood	65 "	Harnett.....	Cameron Hill
Wood	30 "	Burke.....	South Mountains
Wood	30 "	McDowell.....	South Mountains
Wood	30 "	Rutherford.....	South Mountains
Steel	60 "	Cumberland.....	Palestine Church, 10 miles north of Fayetteville
Steel	35 "	Caldwell.....	Hibriten Mountains
Steel	80 "	Bertie.....	Three miles north of Windsor (Norfleet tower)
Steel	102 "	Hertford.....	Near Como. Built by Camp Mfg. Co. under State supervision
Steel	80 "	Pender.....	Near Bannerman's Bridge. Built by Cooper River Timber Co.

In addition to these specially constructed towers, practically all of which are open to the public, two pole towers were erected in Craven County, and a

number of high buildings in coöperating counties have, through the courtesy of their owners, been manned with lookouts during the fire seasons. A ten-year program, beginning July 1927, provides for the erection of 125 towers in the State to complete the primary detection system. This will fit in with the system of lookouts already being used on the National Forests.

Approximately 110 miles of telephone line were constructed during this period. These lines connect towers and other lookout points with District offices and with members of the warden organization. It is only when connected by telephone with the fire fighting force that the lookout on the tower becomes really effective. In many cases telephone communications have been given to outlying sections where telephone lines have not before existed. Most of the telephone lines constructed are of the metallic circuit type.

The following non-expendable fire fighting equipment was purchased and distributed to the warden organization during the period:

- 2,500 fire rakes
- 600 brush hooks
- 100 axes
- 2 shovels
- 1,500 Knapsack pumps
- 26 single Forester pumps
- 3 double Forester pumps
- 5 Vermorel Forester pumps
- 100 water bags
- 288 fusees
- 144 galvanized buckets

A new trailer for transporting equipment, water, food and men to fires was designed by Assistant State Forester McCormick, assisted by the Council Tool Company, Wananish, which is manufacturing this and other equipment. After thorough testing and several improvements, this was made a part of the standard fire fighting equipment. Results obtained have proven so satisfactory that twelve of these have been placed throughout the State, and it is proposed to purchase fifteen additional trailers during the next biennium so that at least one can be placed in each coöperating county in the State, as well as one in each private association area. The trailers are completely equipped to supply twenty men with fire fighting tools and to carry approximately 140 gallons of water. They are being built at a cost of only \$148 each.

Due to the increase in personnel, improvement work and the necessity of transportation, four additional cars were secured during the biennium. There are now eight Department cars operated in the forest fire protection work, as follows: One Dodge coupe, two Ford coupes, three Ford roadsters, and two Ford trucks.

Two adding machines, one typewriter and a number of steel filing cases were purchased for the various District Offices, as well as minor equipment for the general carrying on of the work.

A number of counties have permitted the use of unexpended balances for the purchase of fire fighting equipment and for the construction of improvements. This has made possible the purchase of a lot of equipment which otherwise could not have been secured.

Educational Activities. Motion Pictures: As a part of the fire prevention program, a schedule of motion picture shows, covering all the coöperating

counties in the Eastern part of the State, was given during the period. H. M. Sebring, who had charge of this program, was assisted by the Chief Forest Warden of each District. A continuous six weeks' program was carried out in Districts 3, 4 and 5 during January and February, 1928, using two projectors and twelve reels of films. Shows were made at schools, civic clubs, 4-H clubs, Boy and Girl Scouts, Y. M. C. A. clubs; in fact, any place where gatherings could be obtained. A total of 300 shows were given, which were attended by 30,000 children and 20,000 adults. It is planned to purchase shortly additional equipment so that the entire State may be covered with a program of motion pictures, slides, and lectures.

Exhibits were placed in twenty-four counties and four Eastern Carolina Chamber of Commerce Expositions. It is estimated that 150,000 people saw these exhibits and received large quantities of printed matter dealing with forest fire prevention. Much time and effort has been spent in placing these exhibits. In several cases credit was given for having placed the best booths of any of the exhibitors showing. No State Fair was held in either year but the Division took part in the Sesquicentennial Exposition at Philadelphia in the fall of 1926, Mr. McCormick taking charge for the Department during the final week and the packing-up process. It is felt that the motion picture programs and the fair exhibits reached more people and established better interest in forest fire prevention than any other form of educational activity.

The use of posters and signs has been found of the greatest value in reaching the local and travelling public. They are reminded to be careful with fire, not only because the forest fire laws will be enforced but on account of the loss which every one sustains when the woods are burned. The practice of posting large numbers of warnings along the hard surface highways has been abandoned, partly because the competition with all sorts and sizes of commercial advertising signs as well as the rate of travel makes this of little effect, but mostly because the State Forest Service is actively coöperating with those public spirited organizations and individuals who are seeking to beautify our roadsides. Some 26,000 posters of several styles were printed on durable manilla board and posted at stores, filling stations, mills and other stopping places along our main roads, and at cross roads, on side roads and trails where the public, which uses the forests will see and read them. One of these posters "Think of the Trees! Be Careful with Fire" was designed by the Assistant State Forester, and lithographed in North Carolina. Two others with patent reinforced edges "Prevent Forest Fires" and "Save the Forest" printed in yellow and black were purchased from a firm supplying many other States. A neat white card has also been printed, "Notice! Misdemeanor to Destroy posters, signs, warning notices", quoting the law, has been used in competition with larger posters in neighborhoods where these latter have been defaced. The present tendency is to metal signs. Twenty-five hundred attractive and conspicuous heavy enamelled steel signs 9 inches by 18 inches, showing in yellow letters on a black background "STATE FOREST FIRE WARDEN—Report Forest Fires Here" have been purchased and one will be placed on the edge of the road in front of each County and District Forest Warden's house. They are being erected on neat 4 inch by 4 inch posts painted red and white. These are not only a sure guide to people who wish to report or get assistance in fighting fires, but they are the best warning posters yet used.

Twenty warden meetings were held in the coöperating counties during the period. These meetings are schools of instruction, designed to increase the efficiency of the warden organization and promote a more thorough interest in the work. In the future, annual schools of instruction will be held in each of the coöperating counties.

Eight issues of "The Forest Warden" were prepared by the Assistant State Forester and published; and a total of 25,000 copies distributed to the warden organization, county commissioners, members of the General Assembly, U. S. Forest Service officials, coöperating timberland owners, a forestry exchange list, and all North Carolina daily papers. The object of printing this sheet is to keep the wardens informed as to what their co-workers are doing and to inspire them with the magnitude and importance of their work.

The press of the State has received and published more items dealing with forest fire prevention than ever before. The field personnel has given quite a bit of attention to publicity in the press; this, together with the activity of the Manager of Public Relations in the Central Office, has assisted materially in presenting the problem of forest protection in proper shape to the press for their acceptance.

Forest Warden Activities. It is difficult to summarize the very varied activities of some 650 County and District Forest Wardens scattered over one-third the counties of the State. While the main objective is fire prevention, the chief stress still has to be laid on forest fire control, namely the preparation for fire fighting, the detection, suppression, investigation and report on forest fires. However, as can be seen from the following summary, the educational and publicity campaign, designed to arouse the public to such interest and carefulness that fires will not occur, goes on at the same time. In fact, the first clause in the regular contract, under which county coöperation is carried on, states that "the Department agrees to employ forest wardens for the purpose of taking *****such protective measures, educational and otherwise, as shall seem necessary to prevent forest fires".

The activities of the forest wardens can be summarized as follows:

	1926-27	1927-28
Number of fires handled.....	1,091	1,145
Number of posters posted.....	10,732	10,624
Number of people interviewed.....	18,747	24,910
Number of sawmills inspected.....	469	746
Number of schools and meetings visited.....	572	975
Number of motion picture shows given.....	31	300
Number of prosecutions conducted.....	93	92
Number of miles travelled by auto, horse and on foot	62,565	82,792

Law Enforcement. Since the forest laws have become widely known through previous educational and publicity efforts a greater tightening of the law enforcement program has been going on through the biennium. So strong has public opinion become in favor of forest protection that 70 per cent of the prosecutions brought through the activities of the field organization have brought convictions, 10 per cent have been appealed or are pending, and only 20 per cent of the cases were lost. When a fire occurs the warden in charge immediately investigates its origin. If sufficient evidence can be secured

against the responsible party a prosecution is brought under the forest fire law. If the fire results from carelessness or negligence one of two procedures is initiated. If the fire is accidental and has occurred in spite of seemingly reasonable precautions, or if there is a reasonable doubt as to guilt or in the opinion of the warden, insufficient evidence to convict, the responsible or suspected party is given the opportunity of paying to the State the cost of suppression. On the other hand, if the party has been guilty of gross carelessness or negligence, or if it is not the first offense, or if for any reason a prosecution is indicated, this is usually brought in the Magistrate's or Recorder's court in order to get a decision with the greatest possible promptness. But if the fire was intentional and malice can be shown, the case is beyond the jurisdiction of a Magistrate and must be settled in the Recorder's or Superior courts. The fines paid under conviction of necessity go to the public school fund of the county. If the responsible parties cannot be found, the owner of the land protected through suppression of the fire by the State fire fighting force is frequently given an opportunity of reimbursing the State for the cost of such suppression. Landowners as a rule are only too glad to contribute such small amounts towards the organization by which they have been so greatly benefitted. These reimbursement expenses are credited to the cooperative fund of the county and can be used over again in the forest fire prevention work. In no case is the landowner paid for fighting fire to protect his own property. The following brief summary shows what action was taken and the results obtained in the coöperating counties:

RECORD OF ENFORCEMENT FOR BIENNIUM 1926-1928

Number of prosecutions.....	185
Total fines and costs.....	\$2,454
Number of parties billed for suppression costs.....	285
Total amount received as reimbursement for suppression costs.....	\$3,488
Number of landowners asked for cost of suppression.....	30
Total amount received from such landowners.....	\$75
Total cases initiated.....	500
Total amount of fines, cost and reimbursement.....	\$6,017

Forest Fires. In providing for the annual expenditures for forest fire protection in the coöperating counties it has been found necessary to allot practically half the total amount for actual fire fighting. In bad fire seasons this amount has been considerably exceeded while in favorable seasons less than 50 per cent has been found necessary.

The weather for the biennium has varied from extremely hazardous to very favorable. The U. S. Weather Bureau states that "The dry weather or tendency to light rainfall which was the outstanding feature of 1925 continued through most of 1926, but the annual amount does not show so great a departure from normal as in 1925, and the drift of drought was more to the eastward, there having been considerably more precipitation in the mountains and much less in the coastal plain than during the previous year. *****There was still a tendency to light precipitation through most of the year 1927 though the summer rains were normal and well distributed". More favorable conditions accompanied by the more effective field organization was not reflected in the

number of forest fires which occurred in the coöperating counties. It is, however, shown very clearly in the total area burned over and especially in the area of the average fire. This last is considered the best gage of increasing efficiency.

Two sets of forest fire statistics are secured annually. Those sent in regularly by the appointed forest wardens following each fire in the coöperating counties are as nearly accurate as can be secured from a local, and to a large extent, untrained organization. The following table shows the number of fires by classes, the cause of fires, the area burned over, and the damage done by fires in the coöperating counties where the warden force is required to investigate and report this and other information. The assessment of damage is a difficult problem but every effort is made to get as fair an estimate as possible. It will be noted that the average reported damage for the two years is around \$2.00 per acre.

FOREST FIRE STATISTICS FOR COÖPERATING COUNTIES—BY FISCAL YEARS

	1926-27	1927-28
Number of Fires by Classes:		
A—under $\frac{1}{4}$ acre.....	19	58
B— $\frac{1}{4}$ to 10 acres.....	251	425
C—11 to 100 acres.....	401	487
D—101 to 500 acres.....	345	156
E—Over 500 acres.....	75	19
	1,091	1,145
Causes of Fires:		
Brush burning.....	203	266
Hunters, fishermen and campers.....	120	138
Railroads.....	77	76
Lumbering.....	73	33
Incendiary.....	134	173
Smokers.....	113	174
Lightning.....	20	4
Miscellaneous.....	101	128
Unknown.....	250	153
	1,091	1,145
Area Burned—Acres:		
Merchantable timber.....	112,249	24,035
Reproduction.....	158,874	40,787
Open grass land.....	34,457	11,767
	305,580	76,589
Damage:		
Merchantable timber.....	\$ 285,765	\$ 38,072
Reproduction.....	296,607	78,103
Other.....	36,929	15,665
	\$ 619,301	\$ 131,840
Average area per fire—acres.....	280	67

Since at present there are no forest wardens in the non-coöperating counties, comprising nearly two-thirds of the State, a different method is practiced there. Questionnaires are sent at the end of the year to a select list of voluntary

correspondents asking them to make the best possible estimate of the number, area, and cause of fires which have occurred within their townships. These figures frequently are nothing but wild guesses but they are the best available. They are carefully checked and then used in conjunction with the more accurate figures for the protected area in making totals for the calendar years which are required from all cooperating States by the Federal Government. This is practically the same plan which was adopted in 1909 and which furnished information published in a series of reports on forest fires during the years 1909-1920. Since that date the figures have been a combination of the more accurate figures furnished by regularly appointed forest wardens and the less accurate figures furnished by public spirited citizens through the rest of the State. The following table gives these forest fire statistics for the past nineteen years:

FOREST FIRE STATISTICS, ENTIRE STATE OF NORTH CAROLINA
Calendar years 1909—1927

Year	Number Fires Reported	Area Burned in Acres	Damage in Dollars	Size of Average Fire in Acres	Average Damage Per Fire in Dollars	Average Damage Per Acre in Dollars
1909	607	406,065	\$ 252,404	667	\$ 439	\$.66
1910	706	579,553	526,990	821	775	.97
1911	637	160,225	448,700	250	705	2.80
1912	665	616,051	1,089,784	926	1,639	1.76
1913	551	323,444	706,209	587	1,282	2.18
1914	669	295,000	600,000	462	939	2.03
1915	1,151	412,000	495,000	303	445	1.30
1916	2,212	977,000	3,640,000	442	1,646	3.60
1917	1,833	128,000	673,000	69	367	5.18
1918	1,136	204,000	856,000	180	753	4.20
1919	1,359	253,000	1,255,000	181	923	4.56
1920	1,607	190,000	1,258,000	119	783	6.63
1921	1,632	271,430	1,093,000	166	666	4.01
1922	1,227	180,737	639,000	147	521	3.54
1923	1,308	269,000	820,000	206	627	3.04
1924	2,575	320,508	1,418,957	125	551	4.43
1925	2,684	497,712	1,947,509	185	726	3.89
1926	4,720	721,220	2,112,150	153	426	2.93
1927	3,337	405,322	763,880	122	223	1.88
Totals...	30,616	7,210,267	\$ 10,595,583	.....	.....	.....
Average.	1,611	379,487	\$ 557,662	235	346	1.47

The most important development in the forest protection work, which should be undertaken as soon as funds can be made available, is to extend organized work to every county in the State. A State-wide plan has been carefully considered under which educational and law enforcement work would be conducted in every county but actual fire suppression would be paid for only in counties where the local officials provide an appropriation as at present.

In the non-cooperating counties, the work will be carried out under the supervision of the District Forester and Chief Warden as in the cooperating counties. However, the work in the respective counties will be carried on by but one warden—a County Warden. All forms of fire prevention activities

will be carried out by him; namely, the posting of notices, visiting schools, showing motion pictures and slides accompanied by lectures, inspecting hazards, investigating fires, enforcing fire laws and submitting reports. Fire fighting may be carried out, but only on a volunteer basis since no expenses will be incurred for fire suppression. While fewer fires occur in the middle part of North Carolina, there are serious hazards wherever there are woodlands, and the State Forest Service has now developed to the point where it should be giving service to all the people.

FOREST PLANTING

The increasing interest in artificial reforestation by forest planting is shown by the fact that each year the demand has exceeded the supply. The number of seedlings available was increased six fold in 1927-28 over the supply of the previous year and even this did not meet the requests made by citizens of the State. Planting of forest tree seedlings is advocated only on land not reseeding naturally. The stock was sold at \$3.00 per thousand plus 25c extra per thousand as a shipping and packing fee.

During the planting season 1926-27, 31,000 seedlings were sent into twenty-one counties. These were distributed in small lots because the idea was new and beginning in a small way is advised.

The distribution in the 1927-28 planting season was 185,000. This, as in the previous year, exhausted the supply at the State nursery with a number of applications unfilled. Many of the previous applicants took increasing amounts and one large landowner in Moore County made arrangements for one and a quarter million seedlings to be produced over a period of years.

SUMMARY OF DISTRIBUTION

	1926-27	1927-28
Loblolly pine (<i>Pinus taeda</i>) 1 year.....	18,000	148,011
Loblolly pine (<i>Pinus taeda</i>) 2 year.....		11,275
Longleaf pine (<i>Pinus palustris</i>) 1 year.....	2,000	6,492
Shortleaf pine (<i>Pinus echinata</i>) 2 year.....		7,075
Shortleaf pine (<i>Pinus echinata</i>) 1 year.....	6,000	
Slash Pine (<i>Pinus caribaea</i>) 1 year.....	1,000	7,311
Norway spruce.....	1,000	
Maritime pine (<i>Pinus maritima</i>) 1 year.....	2,000	2,400
Black Locust (<i>Robinia pseudacacia</i>) 1 year.....		1,550
Miscellaneous.....	1,000	704
	31,000	184,818

After careful search, covering some six months, a tract of 9.28 acres one and one-half miles west of Clayton was selected and the purchase from Mr. Ashley Horne finally made January, 1928, at a cost of \$1,200. The deeds were approved by Assistant Attorney General Frank Nash. A frontage of more than 600 feet on highway No. 10 gives this site the publicity and educational value which is so necessary a feature, while the soil which is a Norfolk sandy loam is admirably adapted to growing tree seedlings, especially the pines for which there will be the greatest demand. At the termination of the biennium the site had the following improvements, a tool house and packing shed, a 66-foot deep

well with $\frac{3}{4}$ h. p. gasoline pump, a 1,000 gallon pressure tank, a water distributing system, and a road leading to the tool house. There was at this time an estimated number of 350,000 seedlings, chiefly longleaf and loblolly pines growing on the site. Since there is no house on the property the nurseryman, Addie Pace, goes backwards and forwards daily, leaving the nursery without protection at night and on Sundays. It is planned to construct a cottage on the property as soon as funds can be made available. During the lifting, sowing and weeding season four additional men had to be employed to take care of the work and help with the improvements on the nursery site.

The demand for seedlings of trees which grow naturally in the western counties and which cannot be raised successfully in the warmer climate of the Clayton nursery has made it essential that a branch nursery be established in the mountain region to supply that section of the State. Formerly the demand has been only partially met by making arrangements with a private nursery which has now abandoned the production of surplus stock. The interest in reforestation in the western counties justifies the inauguration of this project.

A plan was inaugurated in the spring of 1928 through which schools were supplied with forest seedlings free of cost for demonstration forest plantings. Twenty-seven schools took advantage of this offer and they planted a total of 6,600 seedlings. No school was given more than 500 trees or less than 100 trees. The object of this distribution project was to establish demonstration forests on the school grounds and thus educate the school children to the value of forest tree planting on denuded and idle land. This policy will be continued as another means of stimulating an interest in the growing tree.

Considerable experimentation was carried on to ascertain the best methods of raising the planting stock and planting it. A circular No. 18, entitled, "Forest Tree Planting in North Carolina," was prepared by Assistant Forester F. H. Claridge. This publication has had a wide distribution over the State.

Among the beneficiaries of this nursery policy was the State Hospital at Goldsboro. After careful examination of the property at the request of the management, Mr. Claridge in December 1926, took 10,000 loblolly pine seedlings to Goldsboro and supervised their planting in some of the low ground which is unsuitable for cultivated crops.

Results from plantations have shown a high percentage of survival and in most cases it has exceeded 90 percent. The slit method of planting has been advocated extensively and a spacing of 7 feet by 7 feet for the pines. Longleaf pine which had been considered difficult to transplant can be successfully transplanted when one year old if care is taken to keep the roots moist at all times. It was found from records kept on one large planting that the labor cost \$4.00 per acre, for the actual planting of the trees. The cost of the seedlings per acre, including shipping, is only \$3.00. This makes an average total cost of only \$7.00 per acre under ordinary conditions in the Piedmont and Coastal Plain regions. In the mountain sections the cost would run somewhat higher due to more difficult planting conditions and the more expensive two or three-year old transplant stock which should be used.

The cultural practice at the State Forest Nursery has also been carefully studied. Present indications point to late fall or winter sowing as best for loblolly and shortleaf pine seed, while early spring sowing is best for longleaf pine seed. It has also been found that loblolly and shortleaf pine need half shade until September and that all shade should be removed from longleaf

pine three or four weeks after germination. The beds of loblolly and shortleaf pine were treated with diluted sulphuric acid which had a beneficial effect in reducing loss from damping off disease. The sulphuric acid treatment, however, seemed to have a deleterious effect on longleaf pine survival. Frequent watering of seed beds was found essential during dry periods and the present watering system has proved effective for this work.

Due to the fact that pine seed is difficult to secure and commands high prices, the Forestry Division collected the cones and extracted with its own force and equipment, 100 pounds of loblolly pine seed in the fall of 1926 and 250 pounds of longleaf and loblolly pine seed in the fall of 1927. A number of pounds of Southern Balsam seed was also collected by the warden on Mt. Mitchell State Park. Most of this seed was used in the State Forest Nursery though some was distributed to farmers in the State. A circular, No. 18, "Tree Seed Collection in North Carolina", was prepared by Mr. Claridge and published to inform tree seed collectors of ways of collection and markets for seed. Several individuals have started in this new industry in the State.

On July 1, 1927 the coöperative agreement with the North Carolina State College which had been operative for two years terminated, due to lack of funds. This brought to a close the services of Mr. Claridge as an instructor in forestry at the college and necessitated the gradual removal of the nursery stock and equipment to a new nursery site.

Highway Planting. The constant requests by civic organizations and individuals for information and help in highway tree planting projects has suggested that this department not only provide expert advice and assistance in the selection of species and planting of shade trees along the improved highways of the States as it has done in the past so far as means were available, but in coöperation with the State Highway Commission undertake the development of a State roadside beautification program to meet adequately the needs and the growing demand for landscape improvement. The employment of a trained man will soon be necessary to supervise planting, inspect cutting along highways and supervise the trimming of trees already on the right of way. Some provision should also be made for the purchase of trees and fertilizers, and stakes for the protection of planted trees to be used chiefly in coöperation with interested civic organizations.

While the Department is not prepared to embark on a policy of growing in the State Forest Nursery suitable trees for highway planting, the difficulty of securing such trees at the private commercial nurseries may make it necessary. An agreement has recently been entered into with the Raleigh American Business Club so that it can grow some trees for their roadside planting project on the State Forest Nursery grounds and under nursery supervision. The Club spends \$50 a year for their care and cultivation. They are wisely using only native species.

FORESTRY GENERAL

The general forestry work of the division which comes directly under the State Forester includes a large number of varied projects relating to nearly all phases of forest interests and activities. For convenience these may be grouped as follows.

(1) *Supervision.* The preparation of the various required budgets and of regular and special office reports takes much of the time of the State Forester

and of the office force; it is a very necessary part of the whole work. The maintenance of the technical personnel requires from time to time considerable correspondence and direct touch with professional foresters and those who employ them. The direction and supervision of the work of the division which is in immediate charge of the two assistant foresters, namely, forest fire prevention and forest planting require much thought and some attention to the details, especially of revenue and costs.

(2) *Coöperation.* This is of three classes; coöperation with Federal agencies, with State Departments, and with organizations, National, State and local.

Federal coöperation is largely through the U. S. Forest Service with which the Department is on most cordial relations. Through agreements which are in effect, the State forest fire prevention work receives a maximum allotment apportioned to any State. For the past two years this has amounted to \$41,438 annually. Efforts have been made to secure from Congress a larger apportionment under Section 2 of the Clarke-McNary law and this Department has joined the U. S. Forest Service in making this request. Under Section 4 of this same law, \$2,000 annually has been received and expended for the growing and distribution of forest tree seedlings to farmers. The terms of the agreements under which these funds are received are extremely liberal to the State, though of necessity certain regulations have to be observed. There has never been any serious difference of opinion between the coöperating officials as to the methods and fairness of expenditures made from these funds.

There are now some 390,000 acres of forest land included in the Pisgah and Nantahala National Forests in western North Carolina. The administration of these forests for fire prevention is much more intensive than can as yet be attained by the State but the closest coöperation exists in the reporting and subsequent action on fires occurring near boundaries of these National Forests. Coöperation in the payment of the lookout man on Mt. Mitchell has been carried on for many years and other federal lookout points have a regular system of reporting to the State Forest wardens, fires which are outside the National Forest. The object of administration of these Forests seems, first, to make them of greatest use to the local population and, next, to assure their permanent and full use to the people as a whole.

The National Forest Reservation Commission, which under act of Congress purchases land for National Forests, has recently decided to purchase a number of small areas in the southern pine region to be administered first of all as demonstration forests but to be under the same general management as the other eastern National Forests. It is hoped that the next General Assembly will authorize the acquisition of sufficient land in eastern North Carolina to carry out the purpose of this Commission. There are large areas of forest land throughout the eastern counties, the management of which could be greatly improved and undoubtedly would be, following reliable demonstration as to the best advisable methods. The State Forester appeared before a Senate Committee in Washington in January, 1928, asking that additional funds be appropriated under the McNary-Woodruff Bill which provides for such purchases.

A notable and energetic campaign in which North Carolinians took a prominent part was brought to a successful conclusion by the passage of the McSweeney-McNary Bill in the spring of 1928. This measure provides a permanent and effective means of supporting the Appalachian Forest Experiment

Station, which is established at Asheville, and the other forest experiment stations of the country. Forestry is such a new art in this country that the need for investigation is very great. The location of the Appalachian Station in our mountain region assures us of the best efforts and most helpful results from the careful study of problems which are of practical value to the people of the State. The State Forester is a member of the Appalachian Research Council, a body appointed by the President of the United States to advise and guide the station in its program.

Among some of the features of *state coöperation* in addition to the agreement of the State Highway Commission to report and control forest fires, mentioned elsewhere, plans are now under consideration to join with that Commission in a state-wide program of highway planting. The division has also received the hearty coöperation of the Department of Education in carrying out forestry instruction and programs in the schools and teachers summer schools. The State Tax Commission has called upon the Department for assistance and information connected with the study of taxation on forest lands and the Department was represented at a special hearing in the spring of 1928 to consider this important subject.

Cordial coöperation exists between the State Forest Service and the foresters of the State Department of Agriculture and of the Agricultural Extension Service. The former devotes a large part of his time and attention to the marketing of farm timber crops, while the latter carries to the farmers information regarding the thinning and other features of management of the farm timber crop which occupies nearly half the total forest area of the State.

Mutual assistance is given and received through coöperation with the North Carolina Forestry Association. This organization, founded in 1911 through the efforts of the Director and Forester of this Department, has had a much larger influence than its membership would indicate in bringing the people of the State to a realization of the value and condition of our timber resources. Annual meetings were held at Morehead City September 1926 and High Point September 1927. The State Forester is a member of the Executive Committee but the management and policy of the Association is entirely independent of State direction. The State Forester is also a member of the Executive Committee of the Southern Forestry Congress which was organized in 1916 at a meeting held under the auspices of the Department as it then existed. The principal object of this Congress is to secure the establishment of well organized and properly supported forestry departments in each of the southern States. The last annual meeting February, 1928, was held in Louisville, Ky., at which Mr. W. C. McCormick represented the Department. The previous meeting was held in Richmond, Va., which was attended by the Director as well as the State Forester and the Assistant State Forester.

From time to time coöperation is arranged with Womens Clubs and other organizations in programs of highway planting or in carrying out other forestry programs.

(3) *Legislation.* During the winter of 1927-1928 much time was devoted to forestry legislation. The needs in North Carolina were studied and an effort was made to secure statutes dealing with the protection and conservation of our forest resources. Bills were prepared and suggested to the General Assembly along the following lines. 1. To control railroad fires. 2. To control saw-mill fires. 3. To declare uncontrolled fires a public nuisance and thereby

assist in the task of preventing them. 4. To amend the law so that restriction of township and county lines in securing fire fighters be removed. This latter was the only one of the four forest fire bills which was enacted into law. 5. A bill was passed changing Arbor Day from November to the first Friday after the 15th day of March. When the November date was made legal the school term was only four months and a large proportion of the schools had adjourned in the spring before planting time had arrived. This made the fall date necessary if the day was to be widely observed by school children. With the extension of the school term so that nearly all schools are in session in March the more desirable spring date has been fixed. 6. A bill to secure and protect vacant and unappropriated lands now belonging to the State and to the State Board of Education was proposed. Unfortunately the bill was so amended that its chief feature, namely, the setting aside of such land as may be desirable for State Parks, State Forests, or State Game Refuges by proclamation of the Governor was prevented. The law in its present form has lost its chief expected usefulness.

(4) *Representation.* The importance of having the State or the Department represented at various meetings and functions is apparent. Not only can the advantages of settlement and trade be effectively demonstrated through such representation but the character of a State's advantages is often gaged by the nature of its representation. Governor McLean has been called upon from time to time to have the State represented at special functions and he has always given these invitations very courteous consideration. At the Governor's request the Department in September, 1927, furnished a yellow poplar (tulip) tree for planting in the National Memorial Grove, Golden Gate Park, San Francisco, Cal. In March, 1928, two longleaf pine trees grown in the State Forest nursery, were shipped to Los Angeles, Cal. and planted with ceremony in the California Botanic Garden by a distinguished group of North Carolinians now resident there.

The State Forester read a paper at the meeting of the North Carolina Pine Association in Charleston, S. C., October, 1926, and made an address before the Izaak Walton League, Wilson, N. C., December, 1926. He also attended, at his own expense, the National Conference on State Parks in June, 1928 and read a paper on "Recreation in State Forests." He made this trip an occasion of studying Forest and Park administration in a number of the western States. Many other meetings have been attended by the various members of the division and addresses made.

(5) *Education.* Since the only way a forestry program can be made effective in this State is to secure the intelligent and permanent support of the people, one of the main efforts of the State Forest Service has been and will continue to be to get the message across to all sorts and conditions of men, women and children. Education in all its relations must be carried on continuously and every available opportunity for putting across the lesson is taken advantage of. Through cooperation with the U. S. Forest Service the services of its chief lecturer, H. N. Wheeler, was secured from January 10 to February 12, 1927. During that period Mr. Wheeler covered the entire State lecturing once or twice a day to schools, luncheon clubs and other audiences. His itinerary was carefully prepared before hand and an official of the State Forest Service accompanied him throughout his trip driving him in a State car. The number of people reached and the publicity secured in the State press amply justified

the program. During the summer of 1927 Assistant Forester F. H. Claridge successively visited a number of the teachers' summer schools and gave illustrated lectures on forestry. About 1,000 teachers, both white and colored, were reached. During the winter and spring of 1927, Mr. Claridge carried on a forestry course at the State College in accordance with the coöperative agreement under which a similar course had been given the previous year. Some thirteen students signed up for the course but only about eight went through with it. During the period about half of Mr. Claridge's time was consumed with the preparation and delivery of three lectures a week and two afternoons of field work. This course was discontinued the following year.

American Forest Week, a National observance, proclamations for which have been issued by the President of the United States and the Governors of the various States has been observed each year the latter part of April. Special efforts have been made to reach as many people as possible with publications, circular letters, addresses and radio talks from the central office and similar activities were carried on by the District Foresters through their organizations. The press of the State has given liberal support by calling attention to the special features, some of the mountain newspapers devoting a large amount of space to this rural educational work. On both occasions Governor McLean's proclamation was printed and distributed along with published material furnished by the U. S. Forest Service, the American Forestry Association, the American Tree Association, and the National Lumber Manufacturers' Association.

The following is a list of activities carried out by the Central and District Offices during the two annual observances:

Pieces of literature distributed.....	15,000
Letters mailed with American Forest Week stamps attached.....	4,285
Schools attended.....	188
Business concerns carrying window displays.....	125
Business advertisements carrying American Forest Week slogans.....	52
Column inches of publicity in newspapers.....	2,000
Number of radio talks given.....	10
Number of slides with American Forest Week slogans placed in theatres.....	33
Members of Service actively engaged.....	179

This observance undoubtedly has had an excellent effect in the prevention of forest fires. Coming, however, somewhat too late to be preliminary to the fire season as it is intended to do in the more northern States there has been a question whether an earlier date would not be of greater benefit to this State and others further south. Following a full discussion of this subject it has been decided to abandon American Forest Week as a National feature and allow the States to arrange group or individual observances.

A feature of the educational work in North Carolina and undoubtedly in other States is the courteous activity of the American Tree Association, Dr. Chas. Lathrop Pack, President, in furnishing free to schools in very large numbers his Primer of Forestry. The debt of this Department and of the school children of the State to Dr. Pack is hereby acknowledged.

(6) *Information.* The collection, compilation and distribution of information about the State's forest resources are important duties of the State Forest Service. The demand for certain specific facts from time to time becomes so insistent that it becomes necessary to go to considerable trouble and expense to secure that information although provision may not have been made for it in the budget.

A Survey of Timber Resources of the various counties of the State was undertaken in the spring of 1928 in order to secure as reliable an estimate as possible of the total amount and kinds of merchantable timber available for manufacture. This information was needed for inclusion in the forth-coming report on "North Carolina Resources and Industries." It is planned to have a competent agent go into every county and secure the best estimates available from leading growers and users of timber products as to the conditions in their counties. R. C. Brown, formerly connected with the U. S. Forest Service, began this county-to-county survey on April 15, a second-hand Ford coupe having been purchased for his use. On June 1, W. A. Peterson of Fair Bluff, N. C., a forester and lumberman by profession was employed to help in this survey. Peterson has concentrated his efforts on the counties in District 3 with which he was most familiar. Mr. Brown has worked in the northeastern Piedmont counties and will extend his activities to the Coastal Plain. It was intended that each District Forester should secure the information for the counties in his own District but owing to press of administrative duties this has been found impossible without waiting too long for the final report. At the end of the period about one-third of the counties of the State had been covered and results so far secured tend to show that the timber supply of the State has been reduced at least 50 percent during the past 20 years.

Following a request by the Director of this Department to the U. S. Department of Commerce that it conduct a *Survey of Non-utilized wood* in our industries similar to the one recently completed in Virginia, an agreement has been arrived at for such a coöperative study. Questionnaires have been sent out by the Division of Wood Utilization of that Department under the direction of Dr. Axel H. Oxholm, asking for information which will show the amount and kind of wood waste now not utilized but which might under more favorable conditions be profitably used. Five thousand copies of Governor McLean's letter as Honorary Chairman, urging coöperation were sent to the industries along with the first questionnaire. Reuben Robertson of Asheville was appointed Chairman of the Federal Committee in general charge of this study. Supplementary lists of sawmills and other industries have been furnished Dr. Oxholm and following the receipt of as many replies as he is able to secure by mail, this Department will, by personal visits, endeavor to secure the desired information from those who have not reported by mail. It is hoped that the resulting information may be used to secure remunerative markets for this material or bring about the introduction of new industries which may use it as their source of supply.

Watershed Study. The need for purer and more regular water supplies for our growing cities and towns has long been recognized. Advantage has, therefore, been taken of the coöperative study being made by the Water Resources Division of this Department on the Durham City Watershed to make a *Watershed Study* relating the forest cover of the watershed to the amount and quality of water furnished. During the summer of 1927, F. H. Claridge, Assistant

Forester, started a general study of the forest conditions on the watersheds of three different streams entering Lake Michie in Durham County upon which stream gaging and silt measuring stations have been established. It is planned to relate the results of these measurements to the nature of the soil and soil cover on the respective watersheds. A more detailed study resulting in a map of the area is planned. The results of this study, which will extend over a number of years, should be extremely useful to all the cities of the State dependant on a surface supply for their water.

Supplementary lists of sawmills and other wood-using industries were secured and turned over to the Census Bureau to be used in securing the required information in making the Census of manufacturers which was carried on during the first half of 1928 by their special agent, Frederick W. Coil, in coöperation with this Department.

A large amount of correspondence asking for all kinds of information has been answered so far as the information has been available. While some of this can be answered by sending printed material, much special information has been given through personal letters. An average of ten letters per day, some of them requiring considerable time and study for reply, have gone out from the State Forester's office in addition to administrative correspondence with the members of the Service.

(7) *Publication.* The Division has prepared and published Circular 15, "Forest Tree Planting in North Carolina," by F. H. Claridge, and Circular 18, "Tree Seed Collection" by the same author. The State Forester prepared "The Conservation Laws of North Carolina" which was published in an edition of 10,000. "The Forest Wardens' Manual," edition 1927, was prepared by Assistant State Forester W. C. McCormick and distributed to forest wardens, county commissioners and others interested in forest fire prevention. Articles on the forests of North Carolina were prepared for the special edition of the Nashville Banner, for the North Carolina edition of the Christian Science Monitor, for the Southern Lumbermen, and for other journals. Information is furnished constantly to the Manager of Public Relations for inclusion in the Department Journal, "Conservation and Industry," and in daily press interviews.

Probably the greatest need now in the State Forester's office is for a director of forestry education. A man technically trained who had experience in both forestry education and publicity could, after becoming familiar with our local conditions, not only relieve the State Forester of a large amount of detailed correspondence but could carry a continuous and well directed campaign of forestry education into our schools and colleges whereas now, only sporadic efforts are possible. A beginning is being made by the proposed appointment of a young forester and the purchase of necessary equipment to give moving pictures on forest fire prevention to the rural schools. This, however, should be coöordinated with a general plan of education to cover every phase of forestry and every class of our population.

STATE FORESTS AND PARKS

Mt. Mitchell State Park. Because most of the problems connected with the administration of State Forests and Parks are essentially forestry problems the care and management of our State Parks has naturally been placed in the Forestry Division of this Department. Mt. Mitchell was the first State Park to be established. The problems have been and still are forest fire prevention.

reforestation, and the regulation of recreation. The Park Warden has formerly been paid in part by the U. S. Forest Service on a plan of coöperation in fire prevention. On account of a re-arrangement of the Federal lookouts this coöperative contribution has been reduced and may be entirely withdrawn. W. H. Simmons, of Old Fort, resigned as Park Warden in December, 1926, and Ed. Wilson, of Busiek, the present warden, took up the work February 1, 1927. His duties include lookout service from the tower during the fire season, courteous attention to the large numbers of visitors to the park, protection of the trees, flowers and other public property from vandalism and the wild life from molestation, maintainance of the trails and of the nursery transplant beds. Some 32,000 people went to Mt. Mitchell over the Perley Motor road in the two years besides those who walked and those who used the Wilson Motor road.

A rough, square stone tower was constructed by Col. C. J. Harris of Dillsboro entirely at his own expense on the summit of Mt. Mitchell to replace the previous temporary structure. This tower is an outright gift to the State "for the benefit of the people of the State and the permanent protection of the forests of the region" as recorded on the tablet placed in the tower by the Department of Conservation and Development in acknowledgement of the gift. On June 17, 1927, the tower was dedicated in a well attended and appropriate ceremony. Finding that the rain penetrated the walls on one side Col. Harris entirely lined the interior of the tower with reinforced concrete the following summer. The structure now is, no doubt, as fine of its kind as can be found any where in the country.

The grave of Dr. Elisha Mitchell, on the summit of the mountain, was suitably marked by a masonry structure in October, 1926, and a wrought iron fence was purchased and erected during the following summer. A suitable tablet has been purchased by the descendants of Dr. Mitchell and this will soon be placed on the grave. The cost of this memorial has been paid from a fund collected for the purpose by the former State Geologist, Dr. Joseph Hyde Pratt, some ten or twelve years ago.

Two private automobile roads have been operating toll systems bringing visitors to Mt. Mitchell. The Wilson road from Cane River Valley to Stepps Gap and extending through some two miles of the State Park has been put in satisfactory shape but not until recently (August, 1928) has unrestricted through communication between these roads been established. The restaurant operated by the Mt. Mitchell Motor Road has paid into the Department some \$200 as its 10 per cent share of the gross receipts.

The replanting of the devastated areas has been retarded not only through lack of available funds but also because of the difficulty of securing planting stock. Two thousand young spruce and balsam seedlings were planted in 1927 and 13,000 in 1928. Of these about 4,000 were balsam and the rest Norway spruce.

It was found necessary to replace the old warden's cabin with a new structure. An attractive looking three-room house has been completed, two of the rooms being assigned to the park warden and the third, a large room reserved for the use of special parties or occasionally necessary occupancy. Owing to the great difficulty of securing suitable building stone, although rock is so abundant, added to the cost of transporting materials and the difficulty of holding suitable labor has involved a cost nearly 50 per cent more than the original estimated

cost of \$2,000. The house, however, will be a credit to the State. The construction was in charge of G. A. Joyner, of Black Mountain.

Fort Macon State Park. Little or no work has been possible either for the restoration of old Fort Macon or the improvement of the rest of the park. In the spring of 1928 the plan of depending on the Coast Guard Service for general oversight of the park was changed and a part-time park warden, Mr. Wilbur Lewis, of Beaufort, employed. He has been cleaning up the grounds and looking after the increasing number of visitors some 10 to 12 days per month. The causeway constructed across Bogue Sound which was opened in the spring of 1928, now makes it possible with a three mile drive along the beach from Atlantic Bathing Beach to reach the park by automobile. It will be necessary to mark properly the boundary of the park and to employ a full-time warden so that adequate protection may be given to the Fort which is of enormous historic and scenic interest.

Experimental planting has been done on a small scale. Several species of pine were planted in the spring of both 1927 and 1928 but few of the trees have survived the difficult soil and climatic conditions combined with the appetites of a roving band of sheep. Actual experiments in the fixation of the sand dunes by methods which have proved effective in other places are planned. The long line of sand banks along our coast to which resulting information would apply makes the early start of this project most advisable.

At the request of this Division the engineers of the Water Resources Division, who were making a study of the shore line on Bogue Bank, have been taking measurements looking to the revision and correction of the older maps of the park area.

Rendezvous Mountain Park and Forest. The promised gift of land to include Redezvous Mountain, 10 miles west of Wilkesboro in Wilkes County, has been consummated and deeds conveying 140 acres of land to the State were made in October, 1926. A plan to devote 40 acres, including the top of the mountain, to public park use and to set apart the surrounding 100 acres for experiments and demonstrations in forestry as the Finley State Forest, has been approved.

At the request of some of the local people a law was passed in 1927 authorizing the State Highway Commission to construct a two mile road from the State Highway to the top of the mountain. As yet this has not been done since it involves a cost also against the county. There is so little demand for an automobile road at present that it would be more economical to construct a good trail and this, it is hoped, may be done shortly.

The State Lakes. Some of the Lakes of Bladen and Columbus counties which were placed in the care of this Department by the Conservation Law have been put under a loose form of administration. Permits for new constructions on the floor of White and Waccamaw lakes have been required and several such permits have been issued. It is proposed now to require all docks, boat houses, pavillions, and other structures as well as boats operating upon these two lakes to take out permits and operate under State license. This seems to be the proper way to control certain abuses which the more frequent use of the lakes by the public will necessarily entail.

The restocking of the lake and the protection of the fish especially during the breeding season has been started. During the period from March 15 to June 15, 1928, large sections of these two lakes, as well as Singletary lake, were

staked off and all fishing in these protected areas was prohibited. W. A. Atkinson, of Elizabethtown, was appointed part-time Lake Warden for White and Singletary Lakes; and Albert Sasser, of Hallsboro, part-time lake warden for Waccamaw Lake and their firm, yet courteous enforcement of the regulations has accomplished much with the full approval of both residents and fishermen. This policy of making the State lakes public fishing and recreation grounds will be continued and extended. In order, however, to make them of greatest permanent benefit to the people of the State an area of shore line should be acquired sufficient to guarantee full access and use by the public. Such lake shore parks could well be parts of more extensive State forests or State game refuges.

Since Waccamaw is the only one of these State lakes which has been surveyed and mapped the Forestry Division secured the coöperation of the Water Resources Division for the survey of the other lakes as funds became available. White Lake was surveyed and mapped in the fall of 1927 and the area shown to be 1065 acres, while the docks and pavillions along the lake shore were found to be in the nominal ownership of 30 different parties. It is planned to continue these surveys until the Department knows definitely the boundaries of all the lakes it has been instructed to administer. The title of these lakes is in the State Board of Education but under the law of 1911 the Board cannot dispose of them since they are to be held permanently by the State for recreation purposes for the benefit of all the people.

The Waccamaw dam constructed under an appropriation by the General Assembly of 1925 began leaking very seriously in 1926. Under the general supervision of the engineer of the Water Resources Division it was repaired at local and county expense. As a result of the extremely high water of the winter 1927-28, the dam again got into bad shape. Nothing could be done to repair it until the water went down so that repair work under the supervision of Mr. Saville had not proceeded very far at the end of the biennial period.

Land Investigation. Chapter 83 of the Public Laws of 1927 directs this Department "to investigate and locate all vacant and unappropriated lands now subject to entry and grant" as well as "to investigate and locate bodies of marsh or swamp land, title to which is now vested in the State Board of Education," with the object of determining whether such parcels of land are suitable for "State Parks, State Forests, State Game Refuges, or Shooting Grounds." After investigating a considerable number of acres on "The Banks" in June, 1927 for which grants had been requested the State Forester made report that none of the areas by themselves were large enough or suitably situated for State purposes. As the Education lands are not located or surveyed until request for purchase has been made, no general examination of these lands can be undertaken. The Department, however, has the hearty coöperation of the State Board of Education which requests a report and approval of all requests for purchase.

The policy of acquisition of land for State Parks to include historic, scenic, and recreational areas has been advocated and will continue to be pushed. Such outstanding features as Linville Gorge, Cullasagee, White Water, Tuckaseegee, Little River and other falls, Roan and Pilot mountains, Indian mounds, and recreational areas along the lakes, sounds, and beaches, should be secured for the permanent use and pleasure of the public before they are exploited

for private gain at the expense of the people. In addition to State appropriations for this purpose it is fair to look forward to gifts of either land or money from private individuals or corporations when public opinion is aroused to the point of expecting and appreciating such action.

FORESTRY DIVISION RECEIPTS AND DISBURSEMENTS

Biennial Period Ending June 30, 1928

RECEIPTS

State Appropriation.....	\$ 74,890.66
Federal Government—Fire prevention.....	69,160.79
Nursery.....	3,788.94
Private Coöperation—Fire prevention.....	3,586.65
Nursery.....	50.00
Parks—Elisha Mitchell monument.....	340.75
State College—General.....	1,000.00
County Coöperation.....	28,283.66
Mt. Mitchell—Concession.....	431.60
Sale of seed and seedlings.....	811.93
Sale of publications.....	87.86
Refunds—Fire fighting and other expenses.....	3,625.56
Miscellaneous.....	183.21
Total Receipts.....	\$ 186,241.61

DISBURSEMENTS

Personal Services—Professional and clerical.....	\$ 130,485.18
Supplies and Materials.....	3,989.82
Postage, Telephone and Express.....	4,258.05
Travel Expenses.....	11,129.94
Printing.....	3,258.20
Auto Upkeep.....	5,500.05
Lights and Water.....	56.90
Repairs to equipment and buildings.....	2,878.23
General.....	2,761.34
Equipment.....	19,967.64
Additions and Betterments.....	1,329.46
Sesqui-centennial Exposition.....	343.00
Total Disbursements.....	\$ 185,957.81

Balance—(Trust Fund Mount Mitchell Monument).....	\$ 283.80
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Disbursements by Sections as Divided in this Report:

Forest Fire Prevention.....	\$ 155,135.03
Forestry General.....	10,657.20
Nursery.....	11,759.06
Parks.....	8,406.52
Total.....	\$ 185,957.81

DIVISION OF GAME

WADE H. PHILLIPS, *State Game Warden*

Assistant State Game Wardens:

C. N. MEASE	District No. 1	Black Mountain
J. P. STEPP	District No. 2	Lenoir
J. A. BARKER	District No. 3	Lumberton
E. P. SIMMONS	District No. 4 and 5	New Bern
J. E. STEERE	District No. 6	Charlotte
W. C. LISK	District No. 7	Richfield
G. A. NICOLL	District No. 8	New Bern
C. J. MOORE	District No. 9	Washington
F. A. RUFFIN	District No. 10	Kelford
J. H. STONE	District No. 11	Wilmington
J. C. THOMAS	District No. 12	Winston-Salem

The North Carolina Game Law was enacted by the General Assembly of 1927 and went into effect June 1, 1927.

The handling of licenses and collections by J. K. Dixon, Assistant Director, also in charge of Inland Fisheries, has been conducted in a satisfactory manner. In order to educate the public to the new law during the first year, and make licenses easily accessible to all hunters, more than 500 license accounts were opened up. This required considerable bookkeeping in Mr. Dixon's office. It is planned for next season to have an average of only one license agent in each county in addition to Clerks of Court.

Warden Service

The set-up of warden service for the first year was necessarily experimental. Our system of ten districts, supervised by Assistant State Game Wardens, has been justified by the results. These men have been uniformly faithful and industrious and by keeping in contact with the county wardens have greatly contributed to the success of the work. As the counties become better organized this year, it is planned to cut down the number of districts.

The selection of the proper men for county wardens has been attended with difficulty. The average salary of \$40.00 was, of course, inadequate. Forest and fish wardens were used whenever possible. In some cases they were not suited to game work and vice versa. Frequent changes had to be made. In spite of these drawbacks, however, the State Game Warden is pleased to report that about fifty of the county wardens have performed their duties so as to entitle them to reappointment.

It is planned for 1928 to place county wardens on a straight salary of from \$75.00 to \$100.00 per month from August to April, plus a reasonable expense for gas and oil used in necessary travel. All the wardens' time will be required during the hunting season. They will not be permitted to receive fees from handling licenses. A proper proportion of these fees should come to this Department to be applied to wardens' salaries. Daily reports will be required from all county wardens.

Law Enforcement

It is a tribute to North Carolina citizenship that the new state-wide game law has been so well received. More than 138,599 citizens have paid license

taxes to the State, amounting to over \$204,000.00, practically without protest. Total cases of violations at this time for the whole State amount to only eight hundred and seventy-five. Certainly many violations occurred which did not receive attention. It is the purpose of the Department during the coming season to have a rigid enforcement. We cannot justify the collection of the hunting tax unless the law is enforced and the supply of game is protected and allowed to increase.

Game Refuges

Another method of increasing the supply of game as provided by the North Carolina Game Law is the creation of game refuges. Many sportsmen and others interested in conservation of wild life have offered tracts of land to the Department for this purpose. The following refuges, location and acreage, have been established to date:

Guilford County Refuge, Guilford.....	3,500 acres
Wayah Bald, Macon.....	10,180 acres
Gibson Woods Refuge, Halifax.....	2,860 acres
Pisgah Refuge, Transylvania.....	100,000 acres
Sauratown Refuge, Stokes.....	30,000 acres
Mount Mitchell Refuge, Yancey.....	22,660 acres
Jefferson Penn Refuge, Rockingham.....	1,200 acres

Total.....170,400 acres

By order of the Board a lease was obtained from J. E. Burleson of Spruce Pine, covering 400 acres of land used by him for several years as a deer park, together with the herd of deer now living thereon, estimated at about 250. The lease runs for ten years and the amount paid Mr. Burleson was \$3,500.00. It is planned to transfer the fawns from the park to other refuges and protected areas which require restocking.

Others under investigation are as follows:

Norfolk-Southern Railroad Company

O. G. Edwards, Nash County

DuPont Company, Gaston County

W. S. Harris, Bladen County

Gore Estate, Burnswick County

E. K. Wright, et al, Wilson County

F. A. Linney, Watauga County

Burton Smith, Halifax County

Holly Shelter Swamp

Camp Manufacturing Company, Gates County

There are sixty-six private game preserves in North Carolina owned by shooting clubs and sportsmen, which control more than half a million acres of land. On these areas game is well protected. Considerable sums are spent annually for propagation and purchase of game for restocking purposes. These organizations take the lead in game conservation and their example is a great help.

The Director is of the opinion that it will be better to establish a larger number of smaller refuges, from 200 to 1,000 acres, rather than a few larger

ones. Unless a refuge is protected and the vermin kept down, it will prove a failure, causing just criticism of the Department's act in establishing it. It is hoped that from 25 to 50 smaller refuges may be created this year. If the right kind of refuge cannot be had without payment to the owner of an annual rental, taxes for example, the Board might afford to assume the cost of such leases.

The Mt. Mitchell and Wayah Bald refuges both have good warden service and the deer and other game thereon have increased.

Plans are under discussion to establish a migratory wild fowl refuge on some of the Mattamuskeet lands, which seem well suited for this purpose.

State Game Farm

The Game Farm at Asheboro is complete and has been operating for about two months. The work of propagating quail and pheasants is progressing as well as could be expected for the first year, having been started late. There is much interest in the farm. Thousands of visitors go there each week. It is estimated, with reasonable luck, 1,000 quail will be reared there the first year. The Department has distributed from the farm a number of pheasant eggs to private parties, many of whom are engaged in pheasant raising for the time. It is estimated that more than 1,000 young pheasants were hatched recently in Davie county alone.

Mexican Bob-White

By order of the Board, \$8,000 was spent in the purchase of 4,000 of these quail for restocking. These were distributed among all the quail counties of the State. The game work of the Department was greatly advertised by the release of these birds. Sportsmen everywhere were pleased. Reports from the Mexican quail released have come from many counties. They do not seem as wild as our native bird. They stick to the place where released, for the most part. Several reports show they are laying at this time.

Vermin

Any program for conservation of game would be incomplete unless active measures are taken to keep down the natural enemies of game birds and animals. This work is of first importance on a game refuge. The New York State Game Warden pointed out recently that on one of the Rockefeller preserves all poaching was strictly prohibited, but year after year the supply of game diminished. Then the fact was found that vermin, having been also protected, had destroyed the game. Wardens in charge of our refuges are required to do special work to rid the areas of hawks, crows, cats and other vermin.

The State Game Warden recommends that the sum of \$10,000 be appropriated, or so much as may be required, to pay a bounty of 25c for each hawk and crow, and that \$2.00 may be paid for each wild cat during the months of September and October of this year.

Much complaint is being made about dogs running at large during the closed season. Wardens are instructed to enforce the law as to bird dogs. The untaxed or outlaw dog is the biggest offender. If an arrangement could be made with the State Board of Education whereby our game wardens could enforce the dog tax law, a forward step would be made. It is the opinion of many that the tax due from outlaw dogs would largely pay our wardens.

Changes in Present Seasons

By correspondence with leading sportsmen it was found their opinion is divided. Some of the strongest arguments are in favor of maintaining the seasons as they are.

The question of foxes is a troublesome one. Judge Lane says foxes should not be classed as vermin. He is strong for the present law, but says foxes should receive recognition. Other fox hound lovers resent paying license when we have no season under the State law for the fox. Others want us to restock foxes. On the other hand, we are asked by many to put a bounty on them.

Budget

The hunting law requires the Board to spend the license funds in the administration and enforcement of the game law, and for the propagation and conservation of game. The rather large surplus at this time is due to the fact that the game budget was originally made out on a basis of \$75,000 total receipts. Otherwise, much more would have been spent on enforcement. However, when all proper costs of administration, enforcement and educational work have been met, the balance of the funds, 25 per cent or 30 per cent, should be spent on the important work of game propagation and game refuges and preserves. For this purpose it is estimated that \$89,110 will be available from this year's receipts.

Game Census

In order to determine to some extent the amount of game in North Carolina, where located, and what success the hunters have, it was decided to take a census of birds and animals taken during the past season. Card questionnaires were mailed to everyone to whom a hunting license was issued. The report follows:

Converting these figures into estimated value of game killed last year it would be as follows: rabbits \$311,054, squirrels \$252,672, deer \$90,000, coons \$42,930, opossums \$324,210, minks-skunks \$50,430, wildcats \$1,800, muskrats \$51,210, quail \$294,594, turkeys \$22,910, grouse \$375, pheasants \$2,115, snipe \$3,508, railcoots \$306, woodcocks \$6,370, dove \$17,007, geese \$15,840, ducks \$51,845.

Total estimated number of game killed last year 4,529,590.

Total estimated value of game killed last year \$1,539,376.

While these figures are only approximate, they are sufficiently accurate to show that it not too late to make North Carolina the first game state in the Union.

State Licenses

Of the total of 138,599 licenses issued last year, it will be noted that 126,035 were county licenses, 11,686 state licenses, and only 878 were non-resident.

HUNTING LICENSES ISSUED DURING SEASON 1927-28

County	Receipts	Resident County	Resident State	Non- Resident
Alamance.....	\$ 3,141.00	1,956	168	23
Alexander.....	524.00	509	3	....
Alleghany.....	421.00	361	12	....
Anson.....	1,747.00	1,567	36	....
Ashe.....	952.00	932	4	....
Avery.....	375.00	335	8	....
Beaufort.....	3,078.00	2,283	117	14
Bertie.....	3,644.00	2,769	121	18
Bladen.....	974.00	794	30	2
Brunswick.....	828.00	733	19	....
Buncombe.....	5,667.00	3,507	402	10
Burke.....	484.00	454	6	....
Cabarrus.....	2,549.00	1,559	198	....
Caldwell.....	1,040.00	945	19	....
Camden.....	870.00	590	11	15
Carteret.....	3,034.00	949	36	127
Caswell.....	979.00	719	13	13
Chatham.....	2,927.00	1,397	66	80
Catawba.....	2,529.00	1,729	148	4
Cherokee.....	1,352.00	1,017	55	4
Chowan.....	779.00	624	31	....
Clay.....	250.00	250	....	....
Cleveland.....	2,309.00	1,784	105	....
Columbus.....	2,690.00	1,760	63	41
Craven.....	3,805.00	2,065	186	54
Cumberland.....	1,909.00	1,029	161	5
Currituck.....	1,148.00	513	10	39
Dare.....	84.00	79	1	....
Davidson.....	3,912.00	2,287	181	48
Davie.....	1,314.00	1,129	28	3
Duplin.....	2,539.00	1,624	180	1
Durham.....	4,185.00	1,315	574	....
Edgecombe.....	2,083.00	1,303	120	12
Forsythe.....	8,459.00	3,159	1,048	4
Franklin.....	1,733.00	1,473	49	1
Gates.....	1,067.00	827	9	13
Gaston.....	2,760.00	1,595	233	....
Graham.....	686.00	511	5	10
Granville.....	1,680.00	1,345	40	9
Greene.....	1,337.00	827	102	....
Guilford.....	7,831.00	2,526	860	67
Halifax.....	4,128.00	3,143	173	8
Harnett.....	1,874.00	1,069	152	3
Haywood.....	1,200.00	980	38	2
Henderson.....	1,074.00	869	38	1
Hertford.....	1,866.00	1,231	49	26
Hoke.....	297.00	172	25	....
Hyde.....	628.00	503	7	6
Iredell.....	2,340.00	1,745	119	....
Jackson.....	1,104.00	824	26	10
Johnston.....	3,712.00	3,007	141	....
Jones.....	846.00	651	33	2
Lee.....	1,232.00	662	105	3
Lenoir.....	3,192.00	1,657	301	2
Lincoln.....	1,309.00	929	76	....

HUNTING LICENSES ISSUED DURING SEASON 1927-28—Continued

County	Receipts	Resident County	Resident State	Non- Resident
Macon.....	\$ 619.00	534	14	1
Madison.....	432.00	417	3	....
Martin.....	2,427.00	1,752	117	6
McDowell.....	1,474.00	1,214	46	2
Mecklenburg.....	5,927.00	3,092	567	....
Mitchell.....	209.00	124	17	....
Montgomery.....	759.00	454	58	1
Moore.....	283.00	163	18	2
Nash.....	4,721.00	2,751	385	3
New Hanover.....	3,080.00	1,140	355	11
Northampton.....	1,936.00	1,831	15	2
Onslow.....	1,558.00	1,083	29	22
Orange.....	1,817.00	1,407	82	....
Pamlico.....	713.00	563	18	4
Pasquotank.....	1,625.00	895	116	10
Pender.....	934.00	764	28	2
Perquimans.....	979.00	749	4	14
Person.....	1,208.00	883	14	17
Pitt.....	4,869.00	2,749	421	1
Polk.....	578.00	488	9	3
Randolph.....	2,587.00	1,332	128	41
Richmond.....	1,762.00	1,032	134	4
Robeson.....	2,868.00	2,143	136	3
Rockingham.....	3,047.00	2,347	125	5
Rowan.....	3,109.00	1,719	263	5
Rutherford.....	1,499.00	1,379	24	....
Sampson.....	1,479.00	1,194	57	....
Scotland.....	834.00	584	50	....
Stanly.....	2,512.00	1,512	197	1
Stokes.....	1,216.00	1,076	28	....
Surry.....	2,199.00	1,679	89	5
Swain.....	619.00	499	21	1
Transylvania.....	228.00	193	4	1
Tyrrell.....	277.00	262	3	....
Union.....	1,716.00	1,471	43	2
Vance.....	1,617.00	1,032	108	3
Wake.....	5,799.00	3,209	506	4
Warren.....	1,395.00	1,095	27	11
Washington.....	1,053.00	843	36	2
Watauga.....	849.00	739	22	....
Wayne.....	3,350.00	2,135	234	3
Wilkes.....	1,577.00	1,337	39	3
Wilson.....	4,228.00	2,483	340	3
Yadkin.....	727.00	657	14	....
Yancey.....	463.00	458	1	....
Total.....	\$ 197,635.00	126,035	11,686	878
Receipts not assigned to counties.....	6,365.00	.....	.....	....
Grand total.....	\$ 204,000.00	126,035	11,686	878

The game census shows that more game was taken per hunter by those having state licenses than by either of the other classes. As a conservation measure, the \$5.00 state license is probably best. It tends to limit the number of state-wide hunters. However, since there seems to be for the present, at

least, a fair supply of game, it is contended by many that a \$3.00 state license would bring in more revenue and be more satisfactory to a large number of hunters. Your State Warden is also of the opinion that the 25c fee for issuing the licenses is too much, and recommends that the Legislature be requested to reduce it to 10c.

Game Breeding

There is also a demand for proper rules and regulations governing game breeding. Our present law allows permits for propagation of game birds and animals. A good many permits have been issued at \$1.00 each. It is well to encourage private breeding of game. The law ought also to permit the licensing of dealers to handle dead game commercially. Farmers might then have the incentive to raise game for sale. This applies particularly to pheasants. Those served in hotels generally come from England where game regulations, as we know, are strict.

Public Information

Mr. Kelly, in charge of Department publications, has given considerable time to game. The pamphlet, "Hunting in North Carolina", has gone to the printer. "Conservation and Industry", the bi-weekly paper of the Department, is being enlarged to take care of more fish and game news. The circulation of this paper will be about doubled so that it may reach more of those interested. The daily and weekly press have been constantly used in the interest of our game program. In six months about fifty articles on game have been furnished the press. Special articles have also appeared in "Field and Stream", "American Game Bulletin", "National Sportsman", "Forest and Forest Life", "Outdoor America", and other national periodicals.

During American Forestry week, the North Carolina Radio Stations were used by the Department. It is planned to continue their use including regular broadcasts on game conservation.

COUNTY	Rabbits	Squirrels	Deer	Coons	Oppossums	Mink—Skunk	Wildcats	Muskkrats	Quail	Turkey	Grouse	Pheasants	Snipe	Rails—Coots	Woodcock	Dove	Geese	Ducks	Total Licenses	Total Persons Reporting	Total Persons Not Reporting
Alamance	11,298	7,698	1	32	1,912	9	7	100	6,124	111	---	9	160	---	69	462	8	138	2,147	879	1,268
Alexander	5,421	3,764	---	44	1,556	41	---	34	3,669	---	---	---	7	---	---	277	---	31	512	345	167
Alleghany	4,698	2,726	---	29	351	190	1	16	3,692	---	---	36	2	---	---	31	---	2	373	229	144
Anson	13,065	6,504	---	12	2,544	94	---	109	5,683	35	---	17	127	2	492	825	93	389	1,603	602	1,001
Ashe	14,194	4,733	---	12	2,402	287	---	183	2,343	---	2	452	---	---	---	35	---	27	936	638	298
Avery	1,933	2,810	50	56	1,291	122	5	64	419	---	---	87	1	---	---	17	---	2	343	293	1,408
Beaufort	3,933	8,039	52	468	1,390	235	16	552	10,489	23	---	5	215	47	70	2,831	170	3,904	2,414	923	1,489
Bertie	5,716	15,997	44	405	1,067	163	1	88	6,035	259	---	---	269	13	137	769	14	399	2,908	1,041	1,857
Bladen	1,633	6,154	48	389	958	106	6	24	7,909	172	1	---	74	30	41	961	18	312	826	375	451
Brunswick	1,457	7,807	87	410	3,173	220	38	4	3,328	148	---	---	190	184	137	1,890	17	851	732	540	212
Buncombe	14,686	13,044	106	468	2,724	265	19	246	5,038	52	19	156	53	22	239	562	3	91	3,919	1,445	2,474
Burke	2,203	1,785	---	84	1,020	17	3	37	1,033	15	---	3	1	18	83	220	---	56	460	197	263
Cabarrus	10,241	3,648	---	---	2,407	54	3	76	4,368	15	---	6	76	3	83	208	---	3	66	1,757	521
Caldwell	6,055	5,651	5	30	2,407	54	7	99	2,253	---	---	6	11	3	11	417	1	31	964	455	509
Canden	2,379	3,276	---	232	456	29	11	139	1,747	80	---	30	78	---	---	230	5	128	616	262	353
Carroll	934	2,866	201	200	379	170	31	9	2,744	124	1	45	90	184	111	2,511	660	9,171	1,112	450	662
Catawba	6,632	3,428	25	7	1,101	36	3	80	4,661	124	1	2	40	47	47	1,647	1	75	745	388	357
Cayuga	12,395	5,700	5	13	1,616	54	---	165	4,487	6	2	---	11	6	105	288	20	65	1,543	729	814
Chatham	5,688	4,556	1	11	1,538	62	---	121	5,550	100	---	2	44	8	105	288	20	65	1,881	482	1,399
Cherokee	4,676	6,377	2	136	3,658	196	16	188	2,370	31	---	4	32	1	151	126	31	137	1,076	515	561
Chowan	804	1,992	9	99	3,800	14	19	18	1,590	24	10	2	64	1	19	209	2	202	655	170	455
Clay	1,921	1,645	---	170	1,286	76	10	15	721	16	---	15	19	1	29	149	2	23	250	132	118
Cleveland	2,825	6	15	6	284	58	4	284	8,906	15	---	9	321	57	375	4,073	---	74	1,889	534	1,355
Columbus	4,011	17,555	66	906	3,132	157	11	14	18,708	77	21	9	93	---	60	2,046	---	372	1,864	1,182	682
Craven	2,232	6,305	41	426	1,008	70	2	144	4,941	106	---	2	69	---	52	343	31	1,931	2,305	576	1,729
Cumberland	2,909	3,425	4	478	552	33	---	39	7,635	9	---	20	228	148	38	415	1,183	5,982	338	856	284
Currituck	2,202	2,922	6	412	617	48	---	1,517	1,925	---	---	10	16	---	---	9	91	132	80	52	28
Dare	356	372	10	48	145	48	4	72	1,800	---	---	9	200	---	116	357	2	94	2,516	989	1,527
Davidson	13,454	7,072	2	22	2,696	57	29	205	5,208	3	---	10	9	---	116	357	2	94	2,516	989	1,527
Davidson	8,855	5,728	10	22	2,696	57	29	205	5,208	3	---	10	9	---	116	357	2	94	2,516	989	1,527
Davidson	8,855	5,728	10	22	2,696	57	29	205	5,208	3	---	10	9	---	116	357	2	94	2,516	989	1,527
Duplin	7,312	10,866	70	249	2,912	101	10	142	12,302	15	2	32	96	---	205	965	11	231	1,805	927	878
Durham	5,239	3,755	---	4	939	44	---	176	6,874	8	---	---	170	17	205	965	11	231	1,805	927	878
Edgecombe	5,899	5,926	8	140	784	43	---	176	6,874	8	---	---	170	17	205	965	11	231	1,805	927	878
Forsyth	22,215	12,285	7	20	4,823	121	---	160	6,874	40	2	42	269	3	57	1,001	15	400	1,859	541	1,348
Franklin	6,972	4,446	6	34	1,792	44	---	252	9,133	8	---	11	128	1	110	595	24	180	1,435	493	942
Gaston	11,808	5,151	---	34	1,792	44	---	130	3,251	49	---	11	201	1	110	595	24	180	1,435	493	942
Gates	2,948	4,793	5	371	1,933	2	3	59	8,852	---	---	13	13	---	51	1,243	7	143	849	792	57
Graham	1,149	3,518	---	120	1,434	53	1	35	2,702	45	---	49	69	---	26	11	6	75	1,828	431	1,397
Granville	5,662	3,942	6	78	895	48	1	1	307	22	---	13	13	---	26	11	1	75	1,828	431	1,397
Greene	4,515	4,793	10	51	1,388	48	---	58	4,927	48	---	49	13	---	12	217	8	23	1,394	413	981
Guilford	12,678	9,201	2	20	2,924	36	---	58	3,543	7	---	13	177	---	130	293	14	91	929	436	493
Halifax	14,034	15,836	54	397	3,150	156	1	224	9,452	42	35	7	110	2	98	480	74	388	3,453	1,091	2,362
Harnett	4,356	4,354	17	84	1,073	16	3	22	10,559	183	---	6	329	3	322	635	16	371	3,324	1,224	2,004
Haywood	2,135	2,741	23	225	92	278	5	105	2,567	23	10	13	230	2	64	151	6	171	1,224	462	762
Henderson	5,442	4,956	90	172	2,319	183	6	109	3,252	3	2	23	59	7	1	98	---	10	1,020	315	705
Hertford	5,260	9,146	43	363	1,379	60	---	28	2,408	46	---	6	150	1	79	320	8	173	1,008	538	470
Hertford	5,260	9,146	43	363	1,379	60	---	28	2,408	46	---	6	150	1	79	320	8	173	1,008	538	470

1,139	1,406	2	75	391	8	1	722	2,225	1,784	6	10	4	7	191	1,368	1	197	92	105
Hoke.....	1,822	59	113	317	55	1	272	2,225	1,784	6	11	89	4	21	1,030	516	239	277	516
Hyde.....	5,694			1,870	68	12	210	4,061	5	5	19	20	10	34	16	104	1,864	700	1,164
Iredell.....	2,979	5	89	1,507	148	5	64	681	20	2	3	70	2	11	40	800	286	574	
Jackson.....	13,256	2	88	3,152	64	1	157	19,342	21	13	8	621	15	145	27	258	3,148	4,01	1,657
Jones.....	3,758	64	165	587	26	2	68	4,334	34	7	10	44	5	62	874	3	686	280	406
Lee.....	3,758	2,001		648	9		50	1,735	23		10	88		52	84	3	1,111	760	209
Lincoln.....	3,371	3,997	5	621	45	10	89	7,196	13	13	3	137		5	1,550	4	1,960	442	1,518
Lowndes.....	5,621	2,239		1,918	3	1	29	1,491	20	2	79	10	2	15	330	4	1,005	294	711
Madison.....	4,000	1	405	310	310	10	116	1,110	646	74	43	16		7	31	208	549	346	263
Macon.....	2,289	50	964	99	3	3	33	5,048	11	6	3	293		82	637	6	8	1,875	539
Martin.....	9,624	18	536	1,064	245	2	33	5,048	74	10	13	14		14	203	25	1,262	493	709
McDowell.....	3,480	7,071	2	1,975	120	13	128	841	10	111	2	155	2	155	2,293	34	227	3,659	1,006
Mecklenburg.....	15,908	7,143	6	1,131	36		100	5,904	48	3	3	3		3	3		141	43	98
Mitchell.....	329	212		1,46				226	1										
Montgomery.....	4,072	2,509	2	912	9		67	3,005	9	20	80	1		35	256	1	84	513	248
Moore.....	3,082	2,288		60	452	24		5	4,391	20	17	77		30	298	10	109	707	268
Nash.....	6,492	3,46	3	159	1,404	87	1	192	4,842	24	1	411		4	136	690	10	109	517
New Hanover.....	1,494	2,780	10	149	438	50	2	2,845	21	2	102	185		85	1,143	14	1,218	1,506	442
New Northampton.....	7,398	11,327	17	276	1,241	69	1	97	3,978	113	762	4		82	358	19	1,848	800	1,048
Onslow.....	2,016	6,049	60	262	952	284	19	33	3,537	66	48	25	100	1,132	20	1,086	1,134	454	680
Orange.....	6,031	4,896	2	25	931	32		30	4,352	64	4	16	4	78	366	56	1,489	472	1,017
Pamlico.....	2,349	1,604	8	131	341	18	5	22	2,089	4	37	77		4	1,110	56	1,010	585	150
Pasquotank.....	3,492	6,438	6	147	366	56	1	44	3,475	63	216	1		61	363	1	68	914	433
Pender.....	2,344	8,583	213	405	1,415	211	1	51	7,707	9	1	41	18	57	403	11	830	764	536
Pernambuco.....	6,531	5	401	1,065	89	5	39	6,459	89	6	21	131	3	76	414	30	356	3,137	810
Person.....	6,145	4,669	8	388	1,369	54	22	185	9,521	85	12	64	393	3	121	414	30	356	3,137
Pitt.....	1,481	7,707	8	388	1,369	54	22	185	9,521	85	12	64	393	3	121	414	30	356	3,137
Polk.....	2,819	2,200	1	46	792	23		94	369	2	7	50		16	363	1	14	501	584
Randolph.....	8,371	6,252	1	17	2,115	55		245	4	258	3	78		66	249	6	146	362	338
Richmond.....	5,017	2,948	36	58	36						3	45		63	630	6	146	362	338
Robeson.....	5,180	5,948	239	1,690	30	10	52	14,749	6	22	6	24	159	125	1,954	33	219	2,282	589
Rockingham.....	14,458	8,607		2,527	74	1	210	6,873	6	1	33	108		68	245	20	175	2,477	857
Rowan.....	11,323	4,652	7	7	2,527	74	1	210	6,873	6	1	33	108		68	245	20	175	2,477
Rutherford.....	7,132	3,241		1,766	34	6	341	1,832	10	3	3	89		80	798		1,987	680	1,307
Sampson.....	5,476	8,137	200	2,339	112			6,876	53	9	12	108	6	12	1,441	1	30	1,403	485
Stall.....	2,638	2,307	1	27	398	19		30	3,370	6	94	45		53	537	1	74	634	590
Stall.....	5,378	6,378	7	5	17	5		7,803	9	7	54	54		39	458	8	33	1,710	415
Stall.....	14,446	8,447		3,247	43			7,803	9	7	54	54		39	458	8	33	1,710	415
Stall.....	7,419	2,809	5	3,247	43			7,803	9	7	54	54		39	458	8	33	1,710	415
Stall.....	1,147	2,037	5	1,461	43			4,505	3	5	16	81		43	19	43	37	1,773	477
Stall.....	520	455		1,166	41			4,505	3	5	16	81		43	19	43	37	1,773	477
Stall.....	379	1,296	16	31	166	41		4,505	3	5	16	81		43	19	43	37	1,773	477
Stall.....	11,316	3,870	38	122	227	35		576	2	1	16	30	82	1	10	31	2	198	66
Stall.....	5,666	2,539	14	2	1,747	59	4	349	6,106	2	3	30	82	1	10	31	2	198	66
Stall.....	15,152	9,080	24	27	666	14	14	36	3,221	77	2	28	170	34	55	3	103	265	113
Stall.....	5,490	3,702	30	30	1,099	19	92	7,854	33	1	4	523	2	157	1,291	8	165	1,117	346
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
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Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
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Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770
Stall.....	4,231	1,530	5	161	1,099	48	3	81	1,620	1	2	26	5	159	92	377	3	1,134	770

The Director has contracted with makers of moving picture films and with the approval of the Board will purchase six reels showing game and fish views in North Carolina. The lectures of the Forestry Division include special reference to our game work.

There is need for a short illustrated booklet on North Carolina birds. This is being planned by the Director and Mr. Kelly. It is imperative that we use every effort to put across to the youth of the State the message of conservation of wild life.

Several proposals are on file from leading periodicals to advertise the game resources of the State. Such publicity carefully distributed, we think, will be well worth the cost. The Director recommends spending the sum of \$1,000 for this purpose.

Coöperation on Game Program

The other Divisions of the Department have shown splendid coöperation in carrying on the game work, especially the Forestry and Inland Fisheries Divisions. This has resulted in economy, in better efficiency; but the best result is the coördination of these important branches of conservation, impressing the public as to how interrelated and dependent each is upon the other. By using the same wardens in many counties, the same publication, stressing the forestry, fish and game program as a unit, much faster progress has been made with the public.

Another important support has come from the sportsmen. They are, after all, the chief pioneers of conservation in our State. Their active support of the hunting laws and our enforcement officers has stimulated the interest of the general public. The Department has in every way sought to encourage the sportsment to organize. A dozen or more sportsmen's clubs and Izaak Walton Leagues have been organized during the past six months.

The United States Biological Survey, H. H. Bimley of the State Museum, the Biological Department of State College and the University of North Carolina have also coöperated in the solution of some of the game problems.

While county officers at first fought shy of the game law, some of them are now giving active aid, with the prospect of coöperation becoming better in the future.

Non-Game Birds and Animals

Game as defined in the hunting law, when it comes to number, includes only a few of our birds and animals. The game animals are the deer, bear, fox, squirrel and rabbit. The game birds are quail, wild turkey, grouse and pheasant. Furbearing animals are skunk, muskrat, coon, opossum, beaver, mink, otter and wildcat. Migratory wild water fowl, also doves and wild pigeons, are regulated by seasons. The wildcat is outlawed with no closed season. The unprotected birds are English sparrows, horned owls, Cooper's hawks, sharp-shinned hawks, crows, jays, blackbirds, and buzzards. All other wild birds and animals not referred to in the law are classed as non-game birds and animals. They are protected by law at all times. They can only be taken when committing depredations under circumstances set out in the law.

Your State Warden strongly believes we owe a duty to this great body of our wild life, the song birds, the insectivorous birds, the harmless little animals of the field and forest.

Wardens will be instructed next season to give particular attention to the care of this part of our wild life. Our people should be educated against killing

REFUGES

Name	Location (County)	Approx. Acreage	Officials	Some Species of Game Found on Areas	Ownership
Guilford.....	Guilford.....	3,500	Dept. of Conservation and Development	Quail	Public
Wayah Bald.....	Macon.....	10,180	Dept. of Conservation and Development	Deer, turkeys, raccoons, opossums	Public
Pisgah (National Refuge).....	T'vania-Henderson	100,000	C. S. Edmondson, Horse Shoe	Deer, turkeys, foxes	Public
Mt. Mitchell.....	Yancey.....	22,660	Dept. of Conservation and Development	Deer, turkeys, raccoons, opossums	Public
Sauratown.....	Stokes.....	30,000	Dept. of Conservation and Development	Turkeys, coons, opossums, quail	Public
Penn.....	Rockingham.....	1,200	Dept. of Conservation and Development	Quail, raccoons, opossums	Public
Gibson Woods.....	Halifax.....	2,860	Dept. of Conservation and Development	Deer, turkeys, coons, opossums	Public
	Total.....	170,400			

them or destroying their nests. The Department received nation-wide good will last spring when our wardens saved more than a million robins while they rested in Randolph and Lincoln counties. The blue birds, and cardinals, have come back again and have been seen in numbers for the first time in many years. Some nature-lovers have sent our Department their blessings for helping to bring this form of beauty back to our woods.

We plan to coöperate with the agricultural agents in reminding the farmers of the value of wild birds on the farm.

GAME DIVISION RECEIPTS AND DISBURSEMENTS BIENNIAL PERIOD ENDING
JUNE 30, 1928

RECEIPTS

Sale of Hunting Licenses.....	\$ 205,003.00
Sale of Game.....	689.44
Transferred from Audubon Society.....	850.17
Miscellaneous.....	24.00
Total Receipts.....	\$ 206,566.6

DISBURSEMENTS

Personal Services—Professional and Clerical.....	\$ 57,204.56
Supplies and Materials.....	7,597.45
Postage, Telephone and Express.....	4,748.14
Travel Expenses.....	13,412.95
Printing.....	3,782.10
Repairs to Equipment.....	49.48
General.....	476.45
Equipment.....	2,177.37
Purchase of Game.....	12,672.00
State Game Farm.....	14,385.70
State Game Refuges.....	2,351.09
Total Disbursements.....	\$ 118,857.29
Balance on Hand.....	\$ 87,709.32

DIVISION OF COMMERCIAL FISHERIES

CAPT. JOHN A. NELSON, <i>Commissioner</i> ,.....	Morehead City
Assistant Commissioners:	
J. H. STONE.....	Wilmington
E. O. SPENCER.....	Swan Quarter
L. A. QUIDLEY.....	Manteo
N. R. WEBB, <i>Fiscal Clerk</i>	Morehead City
VIRGINIA BROWN, <i>Stenographer</i>	Morehead City
T. R. MCCREA, <i>Bacteriologist</i>	Morehead City

The Fisheries Commission, established in the year 1915, was by an act of the 1927 Legislature combined with the Department of Conservation and Development. Governor A. W. McLean organized the latter Department in 1925 with the view of including in it the then existing Commissions and Boards, whose duty it was to look after the conservation and development of the industries of the State of North Carolina. Although the informed friends of the conservation program believed the Fisheries Commission was functioning as efficiently as it could well be expected to, yet it was thought that by keeping together the related work of the different Commissions and Boards under one department, the industries and, therefore, our State, would be unquestionably benefitted. It is hoped that this change will prove of benefit to the fishing industry as a whole, as it is, in the opinion of the Commissioner, one of the most important industries of the State of North Carolina. And, too, it is hoped this Division will contribute its part to the coöperative plan of conserving the natural resources and of building up the varied industries of the State.

The Fisheries is a big problem which demands a great deal of thought and careful consideration in the making of regulations to protect the industry and those engaged in it. When the Board passes rules and regulations for any of the divisions of this department it knows only too well that it is not pleasing everybody affected by its action. In fact, its primary aim is not to please individuals or classes in the passing of rules, but to do in each instance what will most effectively safeguard a basic industry. Granted that occasionally a mistake is made in reaching a decision in some particular case, yet observation has proved that in the great majority of cases the Board is correct.

On occasion the Chairman and the Fisheries Commissioner have to suspend rules between meetings of the Board. This is not done because it is thought the Board has not passed the best rules for the protection of the industry, but because of weather conditions and other emergencies which arise that make it imperative that these changes be made to safe-guard the interest of the whole industry.

The contact between the Board, the fishermen, and dealers at the meetings goes a long way to convince the latter that the Board members propose to be fair and wish to do everything they can for the fishermen that is consistent with the best interest of the industry. Most of the fishermen give the Commission unstinted coöperation in the enforcement of its rules; while there are a small number who will do almost anything they think they can get away with that is contrary to mutual interests. These are the ones who give the most trouble, for the men who violate the rules ignorantly are few. However, the number refusing to coöperate until they are compelled to do so are growin

smaller as the years go by. During this biennium there have been fewer violations of the regulations than in any other corresponding period since the creation of the Fisheries Commission. This closer coöperation of the fishermen is attributable largely to their education in the purposes, duties and needs of the industry, and to the efficiency and diplomacy of field men who have the enforcement of these regulations in charge.

During this biennium every branch of this Division has shown a marked or slight increase. The oysters and escallops showed the greatest gain, for reasons that will be shown when these subjects are discussed more in detail. There has also been a marked increase in the production of food fish, but the prices paid for them have averaged low. The reason for this is not known to the Commissioner, but he believes that it is due in some measure to the general depression experienced by most of the food markets. The varieties of good fish have been as great and the quality as good as heretofore, but the demand at good prices has been below the general average. The clams and crabs have also shown some increase in catch, but the market has been only fair.

Food Fish

This is the most extensive branch of the industry, but not necessarily the most important. Food fishing which covers a vast area of water is carried on all over the eastern part of the State and is done in many different ways. Some of the methods of fishing are just as unfamiliar to the fisherman in the different localities as they would be to the farmer. For instance, pound net fishing is quite different from long-haul fishing, or the seine fishing from gill and fyke net fishing. A new method is now being introduced known as the trawl-net fishing. This fishing is done in the ocean three miles from the beach, and it has not yet been determined just what effect it will have on the general fishing situation.

In making rules governing these different types of fishing it is found to be difficult to make rules that will benefit one class without injuring another. Regulations covering various seasons for fishing do not always meet the needs of different kinds of fishing. The seasons can not shade off into one another just as the kinds of fishing might require. The run of one variety of fish this season might be a little later than usual, and the run of some other variety might be earlier, thus causing one season to overlap another; or the spawning season may be earlier or later than the season before. Obviously the only thing the Board can do is to base its action on the average taken through a number of years. What applies to the seasons for food fishing applies also to size mesh of the different kinds of nets, because at different seasons fish may vary in size.

The opening of the 1927 shad fishing season promised the best fishing in fifteen years, but on account of a violent wind and snow storm the first of March, which destroyed about ninety per cent of the nets, the season was accounted a near failure. Had it not been for the loss of the nets, the season of 1927 would, in all probability, have been one of the best, if not the best, shad seasons ever enjoyed in our State. The fishermen were discouraged to the point of quitting, and many of them would have done so if there had been any other work for them to do. However, nature oft-times strikes a balance in man's favor, for shad fishing this season, 1928, has been excellent in spite of the fact that there were not so many nets fished as there were previous to the storm mentioned. Many of the fishermen were financially unable to put in their full

stand of nets, but those who were fortunate enough to get in their stand have done splendidly.

Shrimp

The shrimp is the smallest of marketable fish, but like many other things the size does not lessen its popularity. It is considered by some the choicest of seafoods, both on account of its distinctive flavor and the many ways it lends itself to being prepared for serving. This fish is caught chiefly in the ocean. About ninety per cent of those caught in North Carolina come from Brunswick county, around the mouth of the Cape Fear river. There has been an increase of 73,364 pounds put on the market this biennium, which has meant an income to the fishermen of \$11,000.00. During the period under survey 953,956 pounds of shrimp were caught by the three hundred or more fishermen engaged in the work.

Menhaden

Menhaden is the largest single branch of the fishing industry, and has more money invested in it than any other. This class of fishing is almost as hazardous as Lindbergh's flight to France, as there is no way of ascertaining whether or not the result will be successful. The enormous outlay of capital in this business is always at the mercy of the elements. The bulk of the run of fish is during October and November when the ocean is most subject to stormy weather. At times there are untold millions of menhaden off Cape Hatteras and Cape Lookout and, although the big boats are in the midst of them, they do not dare lower their purse boats in an attempt to make a catch, for to do so would be suicidal. All they can do is to watch millions of fish go by that they have been trying day after day to locate.

Had this past season been a normal one from the standpoint of weather the catch of fish would have been the largest in the history of the industry, due to the fact that the fish were plentiful and that there were a great many more boats engaged in the business. As it was there were 329,679,000 menhaden caught which sold locally for \$659,358.00. From this total catch 1,648,395 gallons of oil were manufactured, valued at \$412,098.00, and scrap in the amount of 23,547 tons was manufactured, worth \$588,675.00.

The investment in this phase of the industry amounts to \$670,000.00 in boats, \$67,000.00 in nets and equipment, besides about \$1,195,000.00 in factories. There are about fifteen hundred men engaged in this work, exclusive of the out-of-state crews.

Oysters

The oyster production during this period has gained nearly one hundred per cent over the last biennium. This increase has been in some measure due to sanitary control of the industry, and to opening to the oystermen the grounds on which the Commission had planted thousands of bushels of shells and seed oysters.

Since the Commissioner's last report Dr. P. F. Galtsoff, who is said to be the greatest authority on oysters in the world, and who is now at the head of the scientific investigation of oysters of the United States Bureau of Fisheries, has put on an extensive investigation of the oysters of North Carolina. This investigation has covered a period of about one year, and has been carried on locally by Dr. Siwell. The report of this work has been completed, but so far has not been printed. Dr. Galtsoff came to Morehead City and Beaufort

during March of this year to look after the completion of the report, and while here he visited the different oyster rocks planted by this Division for the past several years in Pamlico and Core Sounds. He was well pleased by the results he found from these plantings, and stated that in every locality where shells were planted they were covered with a good set of young oysters that showed fine growth. He further stated that North Carolina has greater possibilities in the development of the oyster industry than merely to supply cheap oysters for canning, and that many localities in Core Sound, for instance Oyster Creek and Willis' Creek, are suitable for oyster farming.

At Oyster Creek in Core Sound where brush had been planted for experimental purposes, Dr. Galtsoff stated, after studying this method of cultivation carefully, that it showed conclusively this mode of cultivation is suitable for North Carolina waters. Planting of brush is cheaper than planting shells, and he urged this method be given serious consideration and applied on a large scale in all protected harbors and bays. On this survey exceptionally fine oysters were found in Swan Quarter Narrows, Judith's Point, Brant Island, Bay River, Neuse River and Core Sound.

Dr. Galtsoff strongly recommended that oyster planting be carried on by private interests, as he thinks this is the most effective way of building up the oyster industry in the State. In the light of this expert advice and from results realized from shell planting by the Fisheries Commission, it is suggested that shells be planted every year in order to insure the supply of oysters from depletion, and that the Division may demonstrate to private citizens that oyster farming can be done cheaply and successfully.

During this period North Carolina produced 601,850 bushels of oysters valued at \$300,925.00, and the Commission believes with Dr. Galtsoff that the oyster industry has a great future, both from the fact that the State has no polluted grounds and from the fact that other oyster producing states are having to condemn thousands of acres of their best ground every year on account of pollution.

Appended hereto is a brief report of our Bacteriologist covering his work with this Department:

Morehead City, N. C.
May 1, 1928.

Captain J. A. Nelson, Commissioner,
Morehead City, N. C.

Dear Sir:

I wish to submit the following brief report covering the progress of the shellfish sanitation activities carried on by this department in coöperation with the State Board of Health and the United States Public Health Service.

The progress of the shellfish industry of the State of North Carolina has been marked for the past biennium with a steady increase in production and consumption, coupled with a stabilizing effect of the markets. The quantity and quality of the oysters and clams of our waters have been very good, and the season 1927-28 has seen an excellent grade of shellfish offered to the markets, greatly exceeding in quality the product of the previous year.

The problems of sanitary control of the production of shellfish are still of paramount consideration and will continue to be so, so long as we maintain our present status as a shellfish producing state. The season 1926-27 was marked with extensive efforts in sanitary control covering primarily areas of

Wrightsville Sound and the harbor areas of Beaufort and Morehead City. (See report under date of August 1926 and May 1927). The reports referred to here cover sanitary surveys and bacteriological examinations of the entire clam and oyster areas from Little River, S. C., to Beaufort Inlet, N. C., and include intensive studies of the aforementioned Wrightsville Sound and the harbors of Morehead City and Beaufort.

The shellfish season of 1926-27 was one of the greatest years in oyster and clam production that the State has enjoyed within a span of several years, even surpassing the season of 1923-1924. During the latter half of the season our interest was focused upon the sanitary activities already mentioned, and the scientific studies of the productive areas of the sounds of Roanoke, Croatan, Pamlico, Core and Bogue, along with the studies of the brackish waters in and about the mouths of the tributaries of these sounds. (See Siewell's report to P. F. Galtsoff and Galtsoff's report to the Commission.) These reports were made with the end in view of gaining scientific knowledge of the waters of the State as an aid to oyster culture, and to serve as a guide for future shell planting.

The season 1927-28 witnessed a very successful oyster and clam year. The raw markets opened up with a momentum that was indeed encouraging. During the latter part of the season when the warm weather set in this market naturally fell off, but this decline was offset by an early opening of the canning factories, which reported a successful season.

In September 1927 the laboratory was moved to the office from the "Pamlico" and this boat was returned to the patrol service. The sanitary engineer took over the scallop analysis work in addition to the bacteriological and chemical work. In several ways this department was able to contribute its part of the work done in coöperation with the United States Public Health Service and the United States Department of Agriculture toward solving certain problems that will prove of benefit to the industry.

The past biennium has been favorable to the industry and the department has been accorded success in keeping with the efforts to stabilize and increase the markets through sanitary supervision, and to improve the status of the industry as a whole.

Respectfully submitted,

T. R. McCrea, *Bacteriologist.*

Clams

Clamming is the weakest branch of the fishing industry. This is not easy to account for, because the clam can be served by the housewife and cafe chef in a variety of ways. Of course, the Division recognizes the fact that the clam has never been as popular as the oyster and scallop. This is perhaps due to its decidedly strong flavor which is absent in the other shellfish. Yet a great many persons enjoy a steaming chowder when they are hungry.

Thousands of bushels of clams could have been marketed during these last two years had there been any demand for them, but due to the great quantities that were being caught off the Jersey coast and put on the Northern market without delay, this branch of the industry did not show up very well. In addition to this, the humble bi-valve has been under a handicap for the past few years, just as the more aristocratic oyster has been. It has not fully recovered from the scare a certain doctor gave to the public a few years ago concerning it. However, the confidence of the people is gradually being restored

as the clam is now shipped out to New York City, North Carolina's best seafood market, under its health certificate.

Most of the clams come from Carteret and Brunswick counties, although quite a number come from Pender and Onslow and a few from Hyde and Dare counties.

There were 45,524 bushels of clams caught during this period at a value of \$91,250.00.

Escallops

Escallops are especially important among the fishery products of the State. Although the quantity taken is not great, the quality is so much esteemed that the value approaches that of the oyster. The escalloping season comes at a time when other fisheries are slack, and thus fills an important place in the fishermen's activities. Then too, it brings in more to the amount invested than any other part of the industry. Because of these things and because of the fact that the fishery is highly concentrated, being confined to Carteret county, it is tremendously important to those connected with it.

Not only is the scallop industry important to North Carolina, North Carolina is important to the scallop industry. Whereas, according to latest available statistics this state ranked thirteenth for quantity and seventeenth for value of oysters, it ranked third for escallops, being exceeded only by Massachusetts and New York.

Two varieties of escallops are of commercial importance along the Atlantic coast of the United States. These are the bay escallops and the sea escallops. The latter is much larger, has a smooth shell and occurs at considerable depth in the ocean. Although it has been reported off the coast of North Carolina, it is not sought here commercially.

The bay scallop which typically frequents shallow, grassy enclosed waters along the coast, is the commercial form in North Carolina. It is a rapid growing, prolific, but not very hardy animal. Freshets and periods of severe cold are destructive. In 1924 nearly all escallops of marketable size, except those on certain beds near Morehead City, were killed, presumably by heavy freshets. In 1925, when investigations by the United States Bureau of Fisheries were begun from their laboratory at Beaufort, N. C., escallops were very scarce except for a few small areas, but by the fall of 1926, they had become quite abundant. As thus indicated, fluctuations are great, but recovery may be rapid.

Contrary to expectations, the Bureau of Fisheries investigator, J. S. Gutsell, found the bay scallop in North Carolina to be a fall spawner. Spawning begins rather late in the summer, becomes active in the fall and continues into the winter. Individuals from the spawning of mature escallops during one autumn are mature, market-sized escallops the next season, that is when they are little more than a year old. This rapid growth and early maturity account for the fact that the industry recovered fairly well in two years (after 1924) although it required two generations to do so.

Because there is little spawning till fall the young can not become market size escallops during their first winter, and there is, therefore, no need of special protection at that time to enable them to reach maturity. The spawning season is substantially completed by the first of the year, and there remains ample winter escalloping, when escallops which have not completed spawning will

not be destroyed. The winter, thus becomes, from the conservation standpoint, the ideal season for taking escallops.

It is known that some escallops live into their third winter, that is until they are two or a little over two years old. Because so few are left uncaught at the end of the escalloping season, the Bureau of Fisheries investigator has not been able to determine whether or not a considerable proportion would survive. However, it seems not improbable that many would live to spawn again if not caught before their third winter.

The bay escallop is bi-sexual, says Mr. Gutsell, male and female organs being present in one individual. Eggs and sperms are cast into the water where sperms fertilize the eggs. From an egg develops first a swimming embryo and later a swimming larva with a clam-like shell. When this stage is completed the animal (much smaller than the head of a pin) attaches itself to eel grass or other object by a thread. This thread may be renewed if broken. Soon a shell closely resembling, except for size, that of the adult is developed and the phenominally rapid growth to maturity and commercial value is begun.

Around Morehead City, Beaufort and Beaufort Inlet very large escallops grow and sell for \$3.00 per gallon on the local market. Farther away from the Inlet where the water has less salinity they grow in abundance, but are very small and have almost a standard price of \$1.00 per gallon. At the head of Bogue Sound an almost incalculable quantity of these small escallops are found, and it is thought by experts that if a small inlet was cut through the beach in that vicinity and salt water let in, that the result would be a decided increase in the size of the escallops, which would mean thousands of dollars to the fishermen, and incidentally an increase in our revenue. During this biennium the yield of escallops was 165,000 gallons which sold at an average price of \$2.00 per gallon.

Crabs

To many people the crab is the finest dish that can be put before a diner. Its meat is without bones and has a sweet flavor; however, it is not as sweet as the meat of the escallop.

The greatest objection that can be raised against the crab is its price. It is like the terrapin in that its price puts it beyond the reach of the average family. A man can easily eat a dozen soft crabs, and the number required at the price makes it prohibitive for general use.

The catch of soft crabs is confined practically to Carteret county, in the vicinity of Morehead City, Marshallberg, Davis, Stacy and Harker's Island. Although the active season lasts only about six weeks, crabbing means more financially to the people in these sections than any other branch of the industry.

During this biennium 129,523 dozens of soft crabs have been marketed at value of \$129,523.00. In addition to the soft crab business there are crab meat factories for canning at Manteo, Belhaven, Washington and Morehead City, which have put out during this period 39,611 gallons of crab meat at a valuation of \$118,833.00.

Diamond-Back Terrapin

The diamond-back terrapin is probably the choicest seafood on the market today. It is partly for this reason that this Division has for several years been putting forth special efforts to increase its supply. A great increase is expected in the number of terrapins in their natural or wild state during the next two

years because the Board, through the recommendation of the United States Bureau of Fisheries, has had a closed season on them for the past five years, which will be out on April 15th, 1929. It is understood from the fishermen that there are great numbers of terrapins at large in North Carolina waters at this time.

In 1909 the United States Bureau of Fisheries, under the direction of Dr. Samuel F. Hildebrand, undertook some experiments with diamond-back terrapins at its Biological Station at Beaufort, N. C., with a view of learning more about their life history, general habits and behavior. From such studies it was hoped to work out better means and methods for their conservation and possibly, also, for their rehabilitation, as the supply of these animals in nature was diminishing rapidly.

The results of this work exceeded expectations. It was not only learned what the duration of the laying season is, the length of time required for the eggs to hatch, the rate of growth of the young animals and the age at sexual maturity, but it was found also that these animals can be grown in captivity almost as easily as domestic fowls.

Many experiments relative to the feeding and treatment of the terrapins in captivity, as well as breeding for better stock, have been conducted, or are under way at the present time. One of the outstanding achievements of these undertakings is the winter feeding (in a hot house somewhat similar to that used by florists) of the young animals whereby a year's growth is gained the first winter. It has been determined also that by keeping the animals in the nursery the death rate is somewhat lower than if allowed to hibernate as they do if not kept warm.

In 1924 the North Carolina Fisheries Commission Board became interested in the artificial culture of diamond-back terrapins, and a coöperative arrangement with the United States Bureau of Fisheries was entered into, looking toward the hatching of a large number of young each year at the United States Fisheries Station at Beaufort. The young terrapins are to be retained until a year or so old; that is, until they have passed through the critical stage of life and have gained considerable growth, when they are to be liberated in the salt and brackish waters of the State with the view of replenishing the supply in their natural habitat.

This coöperative work is now under way. On October 24, 1927, 6,304 young terrapins of the season's hatch had been removed from the egg beds. This number was considerably increased during the first warm days of spring, when others emerged from the sand boxes used as egg beds. It is expected that about 10,000 terrapins will be hatched in 1928, and that the annual hatch will increase each year until by 1920 there will be from 25,000 to 30,000 young.

Beginning with 1914 a few hundred to a few thousand young terrapins have been liberated annually. The results of these "plants" are becoming evident, as several animals bearing the mark given them upon liberation have been recaptured and observed by those who liberated them. A comparison of the recovered animals with others of the same age retained at the Biological Station would indicate that the rate of growth after the first year is about the same in the wild state as it is in captivity.

Those who have been closely connected with the experimental work of diamond-back terrapin culture firmly believe that terrapin farming could be

made a profitable business, and it is entirely possible that a new industry, namely diamond-back terrapin farming, may be established.

Patrol Boats

The Legislature of 1927 appropriated \$25,000.00 to the Department of Conservation and Development for the purpose of purchasing a boat to assume the duties that our patrol boat "Atlantic" has been faithfully trying to perform for the last twenty-five years. A larger and better boat was recently purchased that is in every way superior to the "Atlantic", and one that will give complete satisfaction in every phase of the work. This boat originally cost \$75,000.00, and though now eleven years old is in splendid condition. The purchase price of the boat did not exceed the amount appropriated by the Legislature. Her length is 76 feet, beam 17 feet, and draft 4 feet, average cruising speed 10 miles per hour. The two-cycle engines, 40-60 horse power each, built in 1923, are in excellent condition. Beside the main saloon 18 feet in length there are two double and two single state rooms with sleeping quarters for eight men. As has been stated above, this boat will do general supervision work in the place of the "Atlantic" which has been sold.

The Division is sorry to have to report the loss by fire on February 16, 1928, of its patrol boat "Neuse" which was stationed at Swan Quarter. The "Neuse" was on its way from Great Island to Swan Quarter in a gale of wind when the engine back-fired and caught from the carburetor. Every effort was made to check the blaze, but in a few minutes it was beyond control. It is practically impossible to save a boat once the gasoline in the bilge water has caught fire. There was not time to scuttle the boat; hence, there was nothing to do but take to the life boat which was done safely.

In connection with the loss of the "Neuse", the Commissioner has been asked a number of times if the boat was insured and his answer has been that marine insurance is so high that it would be poor economy to insure all of the patrol boats. The insurance on the fleet of seven boats would cost enough to buy a new boat every three and one-half years. Moreover, it has always been the policy of the Division to employ engineers who know their business, and who are careful to guard against fires. The burning of the "Neuse" is the first accident that has happened to any of the boats, although most of them have been in the service for many years. For instance, the "Atlantic" has seen service since 1902, or about 26 years. The Commissioner has been in charge of the "Atlantic" for about 22 years, and during that time he has never had an accident, but while plying about the sounds has seen boats burned, sunk and destroyed in other ways.

For further information along this line, the patrol boat "Albemarle" with headquarters at Manteo is used by one Assistant Commissioner in patrolling the waters of Albemarle, Croatan and Roanoke Sounds, and the upper part of Pamlico. This boat is also used in marking off fishing limits in above mentioned territory. The "Roanoke", a small speed boat, with headquarters at Morehead City, is used by an inspector for patrolling the waters of Bogue, Core sounds and; Newport river. The "Croatan" is used in connection with the "Albemarle" in staking off fishing limits. The "Pamlico", which was formerly used on the coast for shellfish sanitation, is now back on full patrol work, and covers the western end of the Pamlico sound, Neuse River, Pamlico river, Core sound and Bogue sound.

These boats represent a capital outlay of \$40,527.60. They are efficiently manned by experienced sailors and are all well cared for. Without these boats the work of the Commission would be so handicapped that it would be practically impossible either to collect licenses or to enforce the rules of the Board. They are the watchment of the fishing industry.

In addition to the patrol boats the Commission has two automobiles, one used by the Commissioner in his work generally, and the other by the Assistant Commissioner located at Wilmington. It was necessary to buy a car for this Assistant Commissioner as he is the field man looking after fresh water streams in the commercial zone, and also the out-of-state boats that fish for menhaden in North Carolina waters.

Hatcheries

On June 30th, 1927, when consolidation with the Department of Conservation and Development was effected, and the commercial fisheries separated, this Division transferred to the Division of Inland Fisheries the hatcheries, valued at \$127,144.56, also one Ford automobile worth about \$200.00. Although the hatcheries were under the supervision of the Fisheries Commission Board for the year July 1, 1926 to June 30, 1927, yet Mr. Dixon, Director of Inland Fisheries, will render a report covering the activities of the hatcheries during the full biennium.

Conclusion

In closing this report the Commissioner wishes to thank the members of the Fisheries Commission Board and the members of the Conservation Board for their loyal support in carrying on the work of this great industry. He wishes also to express his appreciation to those working under him for their coöperation in enforcing regulations and in disseminating information that has made for a better understanding of the policies of the Department. He realizes if the Board, the department personnel and the fishermen do not pull together in this very important work, the conservation program in the commercial fisheries field will fail of achieving its purpose. For this loyalty and coöperation he is indeed grateful.

STATEMENT OF RECEIPTS AND DISBURSEMENTS OF THE DIVISION OF COMMERCIAL FISHERIES FOR THE SEVENTH BIENNIUM ENDING JUNE 20, 1928

Year 1926-1927

RECEIPTS

From pound net licenses.....	\$ 4,300.00
From anchor gill net licenses.....	1,165.25
From drift gill net licenses.....	184.00
From stake gill net licenses.....	328.00
From fyke gill net licenses.....	396.00
From seines under 100 yards licenses.....	26.00
From seines under 300 yards licenses.....	834.00
From seines under 1000 yards licenses.....	243.75
From seines over 1000 yards licenses.....	45.05
From anglers licenses.....	1,235.00
From fish dealers' licenses.....	260.00
From shrimp dealers' licenses.....	12.50
From non-resident shrimp dealers licenses.....	180.00
From shrimp dealers' tax.....	1,412.25
From trawling shrimp licenses.....	51.00
Total food-fish revenue.....	\$ 10,673.25

From oyster tongers' licenses.....	236.25	
From oyster dredgers' licenses.....	1,185.50	
From oystermen's individual licenses.....	41.75	
From oyster dealers' licenses.....	207.50	
From oyster dealers' tax.....	11,574.52	
		<hr/>
Total oyster revenue.....	\$	13,245.52
From clam takers' licenses.....	\$	396.00
From clam dealers' licenses.....	116.00	
From clam dealers' tax.....	1,692.33	
		<hr/>
Total clam revenue.....	\$	2,204.33
From scallop takers' licenses.....	\$	534.00
From scallop dealers' licenses.....	100.00	
From scallop dredgers' licenses.....	336.00	
From scallop dealers' tax.....	2,215.65	
		<hr/>
Total scallop revenue.....	\$	3,185.65
From crab dealers' licenses.....	\$	134.00
From crab takers' licenses.....	40.50	
From crab dealers' tax.....	2,396.90	
		<hr/>
Total crab revenue.....	\$	2,571.40
From menhaden boat licenses.....	\$	9,326.50
From menhaden net licenses.....	115.00	
		<hr/>
Total menhaden revenue.....	\$	9,441.50
From other sources.....	\$	801.79
From compromise settlements.....	6,151.76	
From gas tax refund.....	123.12	
From sale of property.....	221.25	
From power boat licenses.....	804.00	
		<hr/>
Total Miscellaneous Revenue.....	\$	8,101.92
Total revenue from licenses and taxes.....	\$	49,423.57
From emergency fund oyster sanitation.....	\$	7,800.00
From state appropriation.....	20,000.00	
		<hr/>
Total receipts from State.....	\$	27,800.00
		<hr/>
Total receipts July 1, 1926 to June 30, 1927.....	\$	77,223.57
Cash balance July 1, 1926.....		6,204.18
		<hr/>
Total.....	\$	83,427.75
		<hr/>

Year 1927-1928

RECEIPTS

From pound net licenses.....	\$	5,104.00
From anchor gill net licenses.....	1,184.00	
From drift gill net licenses.....	300.00	
From stake gill net licenses.....	493.50	
From fyke net licenses.....	306.00	
From seines under 100 yards licenses.....	281.00	
From seines under 300 yards licenses.....	801.00	
From seines under 1000 yards licenses.....	460.00	
From seines over 1000 yards licenses.....	44.25	
From shrimp dealers' licenses.....	22.50	
From shrimp trawl licenses.....	32.00	
From fish dealers' licenses.....	412.50	
From power boat licenses.....	743.00	
From shrimp dealers' tax.....	972.64	
		<hr/>
Total food fish revenue.....	\$	11,156.39

From oyster tongsers' licenses.....	\$	451.25	
From oyster dredgers' licenses.....		986.50	
From oystermen's individual licenses.....		21.50	
From oyster dealers' licenses.....		333.50	
From oyster dealers' tax.....		12,499.49	
Total oyster revenue.....	\$		14,292.24
From clam takers' licenses.....	\$	142.00	
From clam dealers' licenses.....		85.00	
From clam dealers' tax.....		1,949.57	
Total clam revenue.....			\$ 2,176.57
From scallop takers' licenses.....	\$	619.00	
From scallop dredgers' licenses.....		765.00	
From scallop dealers' licenses.....		105.00	
From scallop dealers' tax.....		6,047.00	
Total scallop revenue.....			7,536.00
From crab trot line licenses.....	\$	25.50	
From crab dealers' licenses.....		90.00	
From crab dealers' tax.....		2,821.74	
Total crab revenue.....			\$ 2,937.24
From menhaden boat licenses.....	\$	14,309.50	
From menhaden net licenses.....		171.00	
Total menhaden revenue.....			\$ 14,480.50
From other sources.....	\$	1,163.28	
From compromise settlements.....		137.00	
From gas tax refund.....		289.04	
From sale of property.....		181.54	
Total miscellaneous receipts.....			\$ 1,770.86
			\$ 54,349.80

**Year 1926-1927
DISBURSEMENTS**

For Board Members' Expenses and per diem	\$	592.66	
For J. K. Dixon, Chairman—salary for nine months		11,100.00	
For J. K. Dixon, Chairman—expenses for nine months		2483.74	
For J. A. Nelson, Commissioner—salary		3,600.00	
For J. A. Nelson, Commissioner—expenses		234.17	
For Assistant Commissioners' salaries.....		5,448.33	
For Assistant Commissioners' expenses.....		1,537.55	
For Inspectors' salaries.....		8,911.26	
For Inspectors' expenses.....		727.40	
For Attorneys' Fees and Court Costs.....		716.15	
For General Office salaries.....		3,500.00	
For General Office expenses—including rent		1,822.27	
For laboratory expenses.....		28.94	
For marking fishing limits.....		248.42	
For printing and advertising, etc.		1,249.10	
For automobile expenses.....		3,181.49	
For general office furniture.....		300.47	
For patrol boat replacement.....		701.30	
For patrol boat operations:			
"Atlantic".....	\$	6,044.27	
"Albemarle".....		3,038.19	
"Roanoke".....		1,281.45	
"Neuse".....		1,546.01	
"Chowan".....		624.88	
"Croatan".....		36.54	
Total patrol boat expenses.....			\$ 12,571.34

For fish hatcheries—construction:

"Morrison".....	\$ 258.10
"Frank Stedman".....	642.20
"Pete Murphy".....	599.60
"Roaring Gap".....	100.00
"Boone".....	3.70

Total hatcheries—construction.....\$ 1,603.60

For fish hatcheries—operation:

"Morrison".....	7,113.95
"Frank Stedman".....	\$ 4,330.90
"Pete Murphy".....	2,977.35
"Roaring Gap".....	4,121.29
"Boone".....	2,642.94

Total hatcheries—operation.....\$ 21,186.43

¹ \$1,600.00 salary included in fish hatchery operations.

² \$685.61 expense included in fish hatchery operations.

For Terrapin Hatchery operation.....	\$ 2,370.99
For oyster bottom—shell planting.....	558.00
For oyster sanitation.....	5,621.82
For automobile purchase.....	1,500.00
For other sources.....	3,632.32
	<hr/>
	\$ 83,427.75

Year 1927-1928

DISBURSEMENTS

For J. A. Nelson, Commissioner—salary.....	\$ 4,200.00
For J. A. Nelson, Commissioner—expenses.....	164.89
For Assistant Commissioners' salaries.....	6,600.00
For Assistant Commissioners' expenses.....	1,191.26
For Inspectors' salaries.....	11,427.34
For Inspectors' expenses.....	488.35
For General Office salaries.....	3,900.00
For General Office expenses—including rent.....	2,001.84

For patrol boat expenses:

"Atlantic".....	\$ 3,818.72
"Albemarle".....	3,089.27
"Neuse".....	1,340.73
"Chowan".....	1,038.46
"Pamlico".....	2,992.95
"Roanoke".....	875.58
"Croatan".....	26.98

Total patrol boat expenses.....\$ 13,182.69

For terrapin hatchery expenses.....	\$ 1,756.08
For oyster sanitation.....	1,665.71
For attorneys' fees.....	318.50
For marking fishing limits.....	336.51
For printing, advertising, etc.	514.30
For automobile expenses.....	3,306.30
For Raleigh office—personal service.....	1,000.00
For Raleigh office—publicity.....	200.00
For other sources.....	1,807.27

Total disbursements.....\$ 54,061.04

Balance with State Treasurer.....228.76

\$ 54,349.80

PROPERTY OUT OF PRESENT WORTH TRANSFERRED TO DIVISION OF INLAND
FISHERIES, DEPARTMENT OF CONSERVATION AND DEVELOPMENT,
ON JULY 1, 1927

Fish Hatcheries:

"Morrison hatchery".....	\$ 28,067.61
"Frank Stedman hatchery".....	33,429.39
"Pete Murphy hatchery".....	24,946.31
"Roaring Gap hatchery".....	25,188.24
"Boone hatchery".....	15,513.01
One Ford automobile.....	200.00

Total value of property transferred.....\$ 127,344.56

INVENTORY—JUNE 30, 1928

Marine Equipment:

Patrol boat "Hedalta".....	\$ 26,000.00
Patrol boat "Pamlico".....	3,386.90
Patrol boat "Albemarle".....	6,266.50
Patrol boat "Chowan".....	2,542.83
Patrol boat "Roanoke".....	1,785.32
Patrol boat "Croatan".....	546.05

Total value Marine Equipment.....\$ 40,527.60

Office Furniture:

One chart rack.....	\$ 56.00
One ship clock.....	13.25
One art metal safe.....	295.99
Three art metal filing cabinets.....	377.72
One steel filing cabinet.....	47.50
Twenty-five steel filing cases.....	101.20
Two sectional filing cabinets.....	100.00
Three flat top desks.....	66.50
One roller-top desk.....	40.00
One high desk and stool.....	67.00
One Burroughs Adding Machine.....	247.00
One mimeograph.....	110.00
Two typewriter desks.....	84.17
Two typewriter chairs.....	31.50
Five typewriters.....	320.50
Chairs.....	73.70
One sectional book-case.....	23.75
One heatrola.....	76.15
One coal bin.....	20.15
One tape moistening machine.....	16.00
One table.....	3.00

Total value office furniture.....\$ 2,171.08

Other property:

Two automobiles.....	\$ 3,000.00
Escallop laboratory.....	371.49
Dock at Morehead City.....	1,268.62

Total value of other property.....\$ 4,640.11

Total Inventory.....\$ 47,338.79
Balance with State Treasurer.....288.76

\$ 47,627.55

DIVISION OF INLAND FISHERIES

J. K. DIXON, *Assistant Director*

MRS. MARY F. HARWARD, *Stenographer*

MRS. LILLIAN BRICKHOUSE, *Clerk*

Under Chapter 57, Public Laws of 1927, the Fisheries Commission of North Carolina was consolidated with the Department of Conservation and Development, the same becoming effective April 1, 1927. As soon as this consolidation act became effective the fishing waters of the State were divided into two divisions; namely, "Commercial" and "Inland".

J. K. Dixon, former Chairman of the Fisheries Commission, was made Assistant Director of the Department and placed in direct charge of the Inland Fisheries of the State. It became his duty to administer the Inland Fisheries Laws, supervise and direct the operation of the State-owned fish hatcheries and collect the Anglers' license fees required under Chapter 60 of the Public Laws of 1927. He was further charged with the duty and responsibility of handling the hunting licenses required under the State Game Law, passed by the General Assembly of 1927. A report of the revenue collected under the State-wide Game Law will appear in report made by the State Game Warden.

Inland Fishing Regulations

As stated above, the Conservation and Development Board, at its regular meeting, July 13, 1927, passed Special Rule 1, designating the "Commercial" and "Inland" fishing waters of the State and directed that all rules and regulations in force at that time, or that might thereafter be passed relative to the fisheries of the State, shall be printed in separate pamphlets.

It is found, since making this change, that it is much easier for the fishing public to find out and understand the fishing laws, as persons who are interested only in the Inland Fisheries of the State do not have to look through one hundred or more rules relating to both "Inland" and "Commercial" fisheries to find what they want. It is also much easier to pass rules regulating the manner of taking fish, seasons, bag limit, etc., since making this change.

The Anglers' Act

Under the Anglers' Act a license is required of those who fish with rod and reel or by casting—its purpose being to require an angler's license only for what is known as the sport fishing in the State. Those who fish by the old-time hook and line method are not required to procure a license. The act provides, also, that no license is required from persons who fish on their own land, or in their privately owned ponds and lakes, or from those who fish in any of the sounds and other waters or streams of the State which do not, in the judgment of the Department, require restocking or replenishment. All revenue collected under this act must be spent for propagating and protecting game fish.

Section 13 of the Anglers' Act provides that on petition of the County Commissioners of any county the provisions of the act can, for good cause shown, be extended to all methods of hook and line fishing in the trout streams of the State, including the right to require a license.

The County Commissioners of all mountain counties of the State, except Henderson, have requested the Department to extend the provisions of the

Anglers' Act to all methods of taking fish from trout streams. This has been done and as a result about 75 per cent of the collections made from the sale of anglers' licenses has come from these counties.

It is recommended that the Department ask the General Assembly to amend this act so that every male person, above the age of twelve years, who fishes with hook and line, or rod and reel, in any of the waters of the State, except possibly the sounds and ocean, shall be required to procure a license.

The Fish Hatcheries

The expense of operating the hatcheries was paid to July 1, 1927, by the Fisheries Commission. An act was passed by the General Assembly of 1925 authorizing the Fisheries Commission to use the unexpended portion of the \$500,000 appropriation made in 1923 for the Fisheries Commission in defraying the operating expenses of the hatcheries. Since July 1, 1927, the expense of operating the hatcheries, building additions and making necessary improvements, has been paid from the appropriation made by the General Assembly of 1927 and from revenue received under the Anglers' Act. The amount expended on the hatcheries—July 1, 1926 to June 30, 1927—will appear in report of Captain John A. Nelson in charge of the Commercial Fisheries Division.

Improvements Made at Hatcheries

During the past year \$6,806.16 has been spent in making various additions and improvements at hatcheries which have added much to their hatching and carrying capacity. A large pond has been added at the "Frank Stedman" Hatchery, Fayetteville. An entirely new 1300-foot, 10-inch pipe line, several new hatching troughs and a number of nursery ponds have been built at Lake James and a number of other smaller additions elsewhere. These additions and improvements have enabled the Division not only to rear more fish but to hold a much larger number to three to six inch fingerling size.

Lake James Hatchery

During the year ending June 30, 1928, the Division built a number of nice nursery ponds at Lake James, Burke County, from funds turned over to it by the Burke-McDowell Fish Commission and from revenue collected from the sale of fishing licenses and permits in Burke and McDowell Counties. The Department took over the administration of the local Burke-McDowell Fisheries Act, passed by the General Assembly, March 9, 1927, which was several days after the passage of the State-wide Angler's Act. The taking over and administration of this local law relieved the Division of a great deal of embarrassment as folks who bought a State fishing license could not fish in Burke-McDowell counties without having to buy a license as provided by the local act.

From a financial standpoint it was well that the Department succeeded in taking over the administration of the law in these two counties as it has collected enough money in excess of actual operating expenses to build a nursery.

Nursery Ponds

The outstanding accomplishment of this Division during the past biennium has been the part it has played in arousing public interest in the building and operating of nurseries for rearing baby fish from the fry or fingerling stage to the four to six inch fingerling size before being liberated in the streams.

The Division is gratified at the splendid coöperation and support it has had in this particular line of its work. Twenty-five or more trout nurseries have been built and operated with marked success this season by either private individuals, Izaak Walton Leagues, Fishing Clubs, counties or towns in the mountain counties of the State. Approximately 400,000 baby fish have been furnished these nurseries from the hatcheries this year. According to reports recently received from a number of them, from their first year's operation, brief statements are given: R. H. Hildebrand, Secretary, Western N. C. Fish and Game League, Asheville, N. C.

"I received 225,000 Rainbow, 104,000 Brook, from State and Federal Hatcheries—loss 15 per cent—practically all on Federal shipments. Have planted in public streams 150,000 Rainbow, three to nine inches in length, and 60,000 Brook, two and one-half to six inches long. I have 40,000 Brook and 30,000 Rainbow in nurseries for later distribution. \$3,500.00 cash spent on nurseries in addition to some team and labor work given. Expect to double capacity of Davidson River Nursery, in Transylvania County. County Commissioners included \$2,000.00 in Budget for this purpose. Everybody immensely pleased. We did more in Transylvania, Henderson and Buncombe counties this year towards stocking streams with real fish than has been done in the past twenty-five years."

Brevard Kiwanis Club, Brevard, N. C.

"Received 16,000 Brook and 10,000 Rainbow from Waynesville and Marion Hatcheries. Loss 1,000 Brook—transporting from hatchery. No loss while in nursery or in planting. Brook one inch long when received—six to eight inches when planted. Fed regularly with beef-hearts. Expect to build more nurseries. Have spent \$400.00 on this one. Will want 25,000 Brook and 25,000 Rainbow next season. Thank you for the interest you are taking in this work. Industries may come and go but to make Western North Carolina a 'Tourists' Paradise' the work you are now undertaking is of the most importance".

William Hall, Cataloochee, N. C.

"Received 10,000 Brook. Loss while held in nursery about 500. Planted balance in streams this fall. Size six to eight inches when planted. Have spent \$5,000 on nursery. Want 30,000 Brook for next season".

Equally as gratifying reports have been received from a number of others, all of whom heartily endorse this nursery pond work and plan to do more along this line in the future.

This work should be encouraged by requiring the hatchery superintendent to visit nurseries and give advice to builders and operators as to proper construction, arrangement of water supply, feeding and caring for fish, etc. The Division is thoroughly convinced, in view of the importance of this work, that it should either relieve the present Superintendent of Hatcheries, Frank J. Reiger, of all duties at the Waynesville Hatchery except to supervise, and require him to give his full time to supervising and directing the fish cultural operations of all hatcheries and nurseries, or employ a competent fish culturist and construction man for this position.

Operations Since Consolidation

On the whole, the work of administering the Inland Fisheries Laws, including the Anglers' Act and the operation of the hatcheries, for the past two years, has been fairly successful. The distribution of fish from State-owned and

operated hatcheries and from Federal hatcheries in the operation of which the State is coöperating, has jumped from 1,775,929 in 1927 to 10,254,542 in 1928. It is true this number has been greatly boosted by the distribution from Edenton and the U. S. Hatchery at Weldon of over 7,000,000 rock fry and about 225,000 yellow perch fry. It is also true that a great many more and much larger fish have been distributed from the State hatcheries in 1928 than any previous year.

Additional hatching and rearing space is being provided at the four trout hatcheries in order that a million eggs may be handled at each, and with the added rearing ponds it is hoped more four to five inch fingerling size may be held than have been held this season. Such as cannot be held at hatcheries on account of insufficient space, water, etc., will be transferred to good nurseries in counties surrounding the hatcheries.

DISTRIBUTION OF FISH FROM VARIOUS STATE-OWNED AND OPERATED
HATCHERIES; ALSO FROM FEDERAL HATCHERIES IN THE OPERATION
OF WHICH THE STATE IS CO-OPERATING

Seasons 1927-1928

Morrison Hatchery, Waynesville, N. C.:

Brook trout.....	640,850
Rainbow trout.....	263,100
Lake trout.....	21,400
Miscellaneous.....	2,330

Total.....	927,680
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"Pete Murphy" Hatchery, Marion, N. C.:

Rainbow trout.....	140,000
Large mouth bass.....	25,000
Loch leven trout.....	65,000

Total.....	204,000
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Boone Hatchery, Boone, N. C.:

Brook trout.....	239,160
Rainbow trout.....	76,554
Brown trout.....	7,900

Total.....	323,614
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Roaring Gap Hatchery, Roaring Gap, N. C.:

Brook trout.....	110,000
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"Frank Stedman" Hatchery, Fayetteville, N. C.:

Large mouth bass.....	171,950
Blue bream.....	4,625
Crappie.....	9,325

Total.....	185,900
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Federal Hatchery, Edenton, N. C.: (State Coöperating)

Large mouth bass.....	24,300
Blue bream.....	400
Miscellaneous.....	35

Total.....	24,735
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Total Distribution for 1927.....	1,775,929
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1928

Morrison Hatchery, Waynesville, N. C.:

Brook trout (2½ to 5 in. fingerlings).....	823,100
Brook (adults).....	138
Brook (5 in. fingerlings—Nov. distribution).....	35,000
Rainbow trout (2½ to 5 in. fingerlings).....	21,000
Rainbow trout (adults).....	279

Total.....	879,517
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"Pete Murphy" Hatchery, Marion, N. C.:

Rainbow trout (2 to 4 in. fingerlings).....	352,750
Blue bream.....	2,775
Large mouth bass (fry).....	233,750
Brown trout.....	18,000

Total.....	607,275
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Note. On hand to be distributed during November 1928.:

Rainbow trout (6 inch fingerlings).....	65,000
Blue bream (4 inch fingerlings).....	20,000
Large mouth bass (3 to 5 in. fingerlings).....	25,000

	110,000
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Total distribution this season—this hatchery.....	717,275
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Note. Of the number of fish distributed from this hatchery during this season 125,400 were placed in private nurseries and held during the summer before being liberated in streams, and about 200,000 Rainbow were held in nurseries at the hatchery—all of which were from 4 to 6 inches long when placed in the streams.

Boone Hatchery, Boone, N. C.:

Brook trout (2 inch fingerlings).....	98,000
Brook trout (3 to 4 inch fingerlings).....	200,000
Brook trout (4 to 5 inch fingerlings).....	200,000
Sun fish.....	16,000

Total.....	514,000
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Note. About \$500 was donated by Watauga County and a number of its private citizens, with which a number of nurseries were built at the Boone hatchery, which enabled the Division to hold, for fall distribution, over 250,000 fish which were 3 to 5 inches in length at the time they were placed in various streams.

Roaring Gap Hatchery, Roaring Gap, N. C.:

Brook trout (1 inch fingerlings).....	50,000
Brook trout (2 to 4 inch fingerlings).....	200,000
Brook trout (4 to 6 inch fingerlings).....	200,000

Total.....	450,000
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Note. Several nurseries were built at or near Roaring Gap, in the spring of 1928, by the Elkin-Sparta Izaak Walton League, Roaring Gap, Inc., and a number of Sparta citizens, which enabled the Division to hold over 200,000 fish through the summer for fall distribution. Quite a number of the fish planted from this hatchery, during the past sixty days, were 5 to 6 inches in length.

"Frank Stedman" Hatchery, Fayetteville, N. C.:

Large mouth bass (2 inch fingerlings).....	105,900
Blue bream (3 to 4 inches fingerlings).....	10,000
Crappie (3 inch fingerlings).....	15,000
Yellow perch.....	755

Total.....	131,655
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U. S. Hatchery, Edenton, N. C.: (Operated coöperatively by State and U. S. Dept.)

Large mouth bass.....	22,600
Yellow perch.....	220,000
Crappie (3 inch fingerlings).....	135
Yellow perch (adults).....	680
Blue bream (inch fingerlings).....	12,300

Total.....	255,715
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Weldon Rock Hatchery, Weldon, N. C.: (Operated coöperatively by State and U. S. Dept.)

Rock (Striped bass).....	7,230,750
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Total distribution for 1928.....	10,254,542
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Lake James Hatchery, Morganton, N. C.:

Large mouth bass (3 to 6 inch fingerlings).....	77,000
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Note. These fish were all liberated in Lake James and Rhodehiss. If the distribution from this nursery had been made in the early spring the number planted would probably have been 200,000, but it is certain much better results will be had by planting this number of large fingerlings than to have planted 200,000 fry.

Private Hatchery, Pineola, N. C., Avery County.

H. C. Marmon, President of the Marmon Car Company, has, at an expense of over \$100,000 built a very fine lake and fish hatchery on the Linville River near his Pineola summer home. His hatchery, nursery ponds and cottage for hatchery superintendent has, no doubt, cost him \$20,000 or more. His purpose, so his superintendent states, is to liberate all the fish he raises in Linville River and his fifty-acre lake. An order has been placed by Mr. Marmon for 500,000 eggs for next season.

In addition to raising fish from eggs purchased by him personally and distributing same, as stated above, he is willing to handle 100,000 fry from the State hatcheries in his nurseries through the summer at his own expense and give the Department 50 per cent in the fall for liberation in streams of other sections of Avery County. This is showing a fine spirit of coöperation and the Division should not only express to Mr. Marmon its appreciation and thanks for his kind offer, but should assist and coöperate with him as fully as it can in the wonderful work he is doing for the Avery county section.

INVENTORY—JUNE 30, 1928

Real Estate, Equipment, etc.:

Morrison Hatchery Waynesville, N. C.....	\$ 28,439.69
"Frank Stedman" Hatchery, Fayetteville.....	35,697.24
Roaring Gap Hatchery, Roaring Gap, N. C.....	25,188.24
Boone Hatchery, Boone, N. C.....	16,153.84
"Pete Murphy" Hatchery, Marion, N. C.....	27,929.99
Lake James Hatchery (Nursery) Morganton, N. C.....	1,178.34
Four trucks (old).....	800.00
One Ford Automobile (old).....	200.00
	<hr/>
	\$ 135,587.34

The above statement has been based on actual book figures. This statement does not include 84 acres of land donated, on which hatcheries are located, which have been valued, by conservative business men, living near each hatchery, at \$16,000.00. Neither does this valuation include money which was donated by counties and private citizens for building roads and purchasing pipe, both of which items amount to approximately \$15,000.00.

FINANCIAL STATEMENT—INLAND FISHERIES DIVISION

Receipts from Anglers' Licenses, year ending June 10, 1927.....	\$ 10,750.20
Receipts from Anglers' Licenses, year ending June 30, 1928.....	16,605.55
Appropriation—Year ending June 30, 1928.....	28,500.00
From private coöperation.....	1,225.00
Miscellaneous, (Refund).....	.72
	<hr/>
	\$ 57,081.47

Expenditures—Year ending June 30, 1927 (Hatchery expenses paid by Fisheries Commission for this year):

Personal service.....	\$ 3,016.53
Supplies and materials.....	21.10
Postage, telegraph and express.....	209.66
Travel expense.....	293.30
Equipment—office.....	348.65
General expense.....	745.49
	<hr/>
	\$ 4,634.73

Expenditures—Year ending June 30, 1928 (All hatchery work included):

Personal service.....	\$ 22,878.33	
Supplies and materials.....	7,084.77	
Postage, telegraph and express	955.58	
Travel expenses.....	1,149.46	
Printing.....	1,381.61	
Auto up-keep.....	1,276.02	
Lights and water.....	34.90	
Repairs.....	1,060.79	
General.....	35.55	
Equipment.....	1,358.45	
Additions and betterments.....	6,806.16	
	<hr/>	
	\$ 44,021.62	
		\$ 48,656.35
Balance.....		<hr/>
		\$ 8,425.12

This balance left over from revenue collected, under the Angler's Act, for year ending June 30, 1927 and June 30, 1928 has been included in budget for year ending June 30, 1929, and is being spent in making necessary improvements at hatcheries, buying equipment and assisting in nursery pond work.

DIVISION OF WATER RESOURCES AND ENGINEERING

CHAPEL HILL OFFICE

THORNDIKE SAVILLE	Chief Engineer	Absent on leave first year Part time second year
CHAS. E. RAY, JR.	Principal Assistant Engineer	Part time first year Full time second year
ELIZA MOORE	Senior Stenographer	First year only
GLADYS SAWYER	Senior Stenographer	Second year only
MRS. H. R. JOHNSON	Junior Stenographer	Employed March 1, 1928
PROFESSOR R. M. TRIMBLE	Engineer	Intermittent employment
PROFESSOR G. W. SMITH	Engineer	largely in summer months
F. M. BELL	Research Assistant in University English School	One-third time second year
A. M. PEELE	Student assistants em- ployed alternately two months	Equivalent of one man second year
E. D. BLAKENEY		

ASHEVILLE OFFICE

E. D. BURCHARD	District Engineer	Full time
KARL JETTER	Engineer	Full time
L. J. HALL	Assistant Engineer	Full time
MRS. EFFIE T. WORKMAN	Statistician-Clerk	Full time
MRS. K. JETTER	Statistician	Full time after May 1, 1928

INTRODUCTION

The following report, in addition to presenting the activities of the Water Resources and Engineering Division for the past biennium, attempts to outline the more important extension of efforts which are recommended for the next biennium. The interests of the Division are of necessity various, and with the increase of its responsibility consequent upon demands for service which are being made, material increases in personnel are required.

If present activities were not expanded and no new activities added, increase of Chapel Hill office personnel by at least one full-time competent engineer is necessary for efficiency. With increase in scope of activities recommended in this report and believed to be fully justified by the needs of the State and demands for services continually being made, provision in the budget is made for employing six additional engineers: one on underground water and drainage investigations; three on coastal, port, and waterway investigations; one on stream pollution and hydrographic studies; one on rural power and airport investigations. Naturally, in an essentially investigating, fact-finding, and promotional organization, personal services constitute the largest item. In the normal expansion of these activities increased personnel is essential.

Requests Received. During the biennium 728 requests for information have been received by the Division. A vast amount of data supplied by such publications of the Division as the Stream Flow and Water Quality Bulletins is

utilized by the public. Typical requests received for data from the Division requiring from one day to one month's time of an engineer are outlined below:

1. Estimates of stream flow at sites for municipal water works or proposed new industries (many received and acted upon).
2. Estimates of chemical quality of water at various competitive points (many received and acted upon).
3. Report on backwater above high bridges (for Highway Commission).
4. Report on hydrological conditions affecting pollution of power lake (for State Board of Health).
5. Power statistical data (for Commerce and Industry Division and many others).
6. Preparation of county maps (for State Board of Health).
7. Salinity effects of tidal and river flow in sounds and estuaries.
8. Inspection of various alleged instances of stream pollution (many received and acted upon).
9. Water Resources exhibit at State Fair and other exhibitions.
10. Mapping of State parks and lakes (Forestry Division).

These are merely indicative of requests received demanding much time and attention with resulting interference to technical fact-finding activities. These will unquestionably continue to increase. The present personnel is entirely insufficient to properly handle the present or prospective future demands.

Very fortunately the Division enjoys a hearty coöperation with the Engineering School of the University, which is the sole reason by which so extensive a program of activity has been possible in the past with such a restricted personnel. The Engineering School has contributed excellent office space, and when special studies are called for, such as the Bridge Report for the Highway Commission or the Coastal Investigations in summer, it is possible to get highly trained personnel for temporary employment at a minimum of cost. In no other way could the Division have accomplished what it has.

However, the mere routine work has now grown to such proportions that more full-time personnel is an absolute requisite. Only the assistant engineer, Mr. Ray, is on a full-time basis, together with two stenographers.

This report outlines technical activities being prosecuted by the Water Resources and Engineering Division, as follows:

1. Stream Gaging
2. Power Studies
3. Hydrological Studies
4. Coast, Ports, Waterways
5. Stream Sanitation and Conservation
6. Chemical Water Analysis
7. Drainage
8. Underground Water Investigation
9. Mapping
10. Airports

1. STREAM GAGING

The Division has been greatly handicapped during the past two years in meeting requests from municipalities, power companies, and State departments for the establishment of new stream gaging stations. The last Legislature did

not accede to the requests of the North Carolina Section, American Water Works Association, North Carolina Society of Engineers, and others for an appropriation of \$20,000.00 for stream gaging and granted only half this amount. As a result, the 51 stations operated in 1925 had to be cut to 39 in 1926. Table I shows the number and type of stream gaging stations operated since the formation of the Division in 1920. Figure I shows this data averaged by years. Table II shows type and location of all active stream gaging stations as of October 1, 1928.

Attention is called to Table III showing for the past biennium the increase both in the total number of stations and of those equipped with recorders, an increase which has occurred in spite of the inadequate funds. This increase is due solely to the fact that certain municipalities and power companies have needed these stations so badly that they have furnished the *entire* funds for installation and operation of some 14 new stations. The increase in number of stations shown on Figure I as occurring between June 30, 1928, and December 31, 1928, is accounted for entirely by complete coöperative financing.

This coöperation for 14 new stations during 1928-29 will amount to \$7,385.00 for construction and \$4,395.00 for operation. The entire salary and expenses of a new assistant engineer for the present fiscal year will be carried by these funds. It is important to note that after July 30, 1929, these contracts provide that operation charges of \$300.00 annually per station revert to the usual basis, whereby the State bears one-half and the coöperating party one-half the cost. If additional state appropriations to take care of this item are not forthcoming, these stations representing a construction investment of over \$7,000.00 will have to be abandoned and the Division will be open to charge of bad faith, even though the contracts specify dependence upon new appropriations for future operations. It is not only a real obligation of the Department to see to it that these stations are continued on a fifty-fifty basis, but represents a situation which will prohibit much further work in meeting the State's stream gaging needs if this reasonable amount of state coöperation is not provided for.

On June 30, 1928, there were 50 stream gaging stations in operation, of which 28 were equipped with recorders, representing the best type of installation. By the end of 1928 there will be at least 64 stations in operation (see Table II) representing the greatest number ever operated in North Carolina and a larger number than in any other southern state. It is of interest to note that in starting on an extensive new stream gaging program recently the Virginia Department of Conservation and Development has pointed to North Carolina as an example of effective work in this line.

During the next fiscal year at least ten requests are expected for gaging stations which cannot be met due to lack of funds. It should be realized that studies of municipalities, power companies, and State departments relating to water supply, water power, sewage disposal, stream pollution, and industrial water cannot be carried out unless requests for new stations can be met. An item of \$19,900.00 annually in the budget for the next biennium, as compared to \$10,510.00 for the year 1928-29, has been included to care for the operation of a total of 75 stations, the operation of all new stations to be on a fifty-fifty basis and whereby the coöperating party pays entire construction expense. A tabulation of stream gaging finances for the past two fiscal years is shown in Table IV. Attention is called to the fact that the State has contributed only a little more than half the total expended under direction of the Division.

TABLE I—GAGING STATIONS MAINTAINED AND CURRENT METER MEASUREMENTS MADE IN NORTH CAROLINA

Year	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Year
1920	A 7	7	7	9	9	8	8	8	8	8	8	14	8
	B 8	0	3	11	0	2	1	2	0	5	1	65	48
	C 27	20	20	20	20	20	23	24	24	24	26	25	32
1921	A 21	11	1	16	0	1	21	24	24	30	2	11	162
	B 25	25	24	24	24	23	23	25	25	25	27	26	25
	C 12	4	7	8	4	3	16	25	6	0	8	1	24
1922	A 28	28	28	29	29	28	28	29	29	29	31	31	29
	B 7	6	11	3	4	20	14	9	11	7	3	10	105
	C 31	31	30	30	31	31	31	34	35	37	37	38	36
1923	A 1	5	14	19	2	0	11	18	17	31	13	12	143
	B 39	39	40	40	41	45	47	48	47	49	51	49	45
	C 18	9	8	20	14	20	53	70	30	17	7	1	267
1924	A 53	54	55	55	56	54	54	54	59	39	39	39	49
	B 24	34	11	21	26	26	23	13	10	17	4	40	249
	C 39	39	40	40	41	41	43	45	46	46	47	47	43
1925	A 3	5	29	22	2	10	21	19	44	67	45	17	167
	B 47	47	47	48	51	50	54	56	57	61	66	67	53
	C 26	26	26	26	26	29	31	53	35	35	35	36	29
1926	A 1	7	24	28	51	24	15	36	80	23	20	31	338
	B 3	5	29	22	2	10	21	19	44	67	45	17	167
	C 47	47	47	48	51	50	54	56	57	61	66	67	53
1927	A 26	26	26	26	26	29	31	53	35	35	35	36	29
	B 1	7	24	28	51	24	15	36	80	23	20	31	338
	C 3	5	29	22	2	10	21	19	44	67	45	17	167

EXPLANATION

A—Total number of gaging stations maintained each month and year (Average number).

B—Number of stations that were equipped with recorders.

C—Total number of gagings (Current meter measurements).

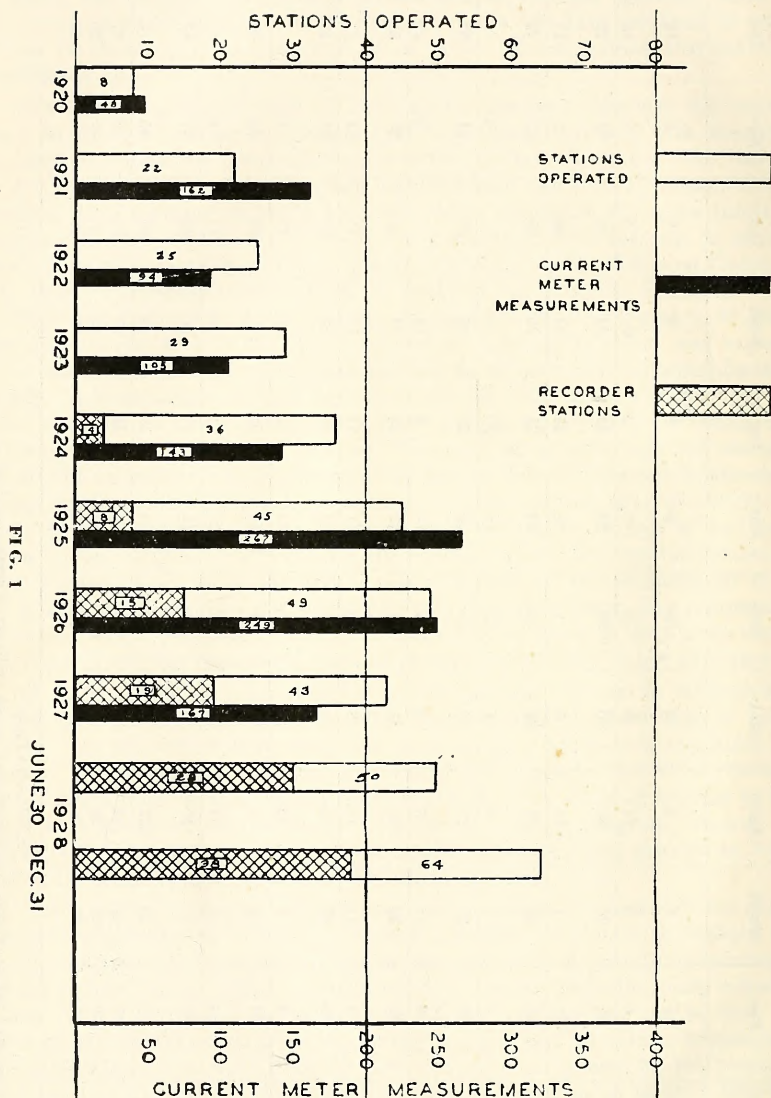


TABLE II—ACTIVE STREAM GAGING STATIONS IN NORTH CAROLINA

October 1, 1928

Number	Stream	Station	County	Date Established	Type
	ROANOKE RIVER BASIN				
106	Roanoke River.....	Old Gaston.....	Northampton.....	12/ 7/11	Recorder
109	Dan River.....	Francisco.....	Stokes.....	8/16/24 ¹	Chain
	NEUSE RIVER BASIN				
304	Flat River (above Lake).....	Bahama.....	Durham.....	7/16/25	Recorder with weir control
305	Rocky Creek.....	Bahama.....	Durham.....	10/ 4/25	Staff with weir control
306	Dry Creek.....	Bahama.....	Durham.....	10/ 9/25	Staff with weir control
307	Dial Creek.....	Bahama.....	Durham.....	10/ 9/25	Recorder with weir control
308	Neuse River.....	Northside.....	Durham.....	7/27/27	Recorder
309	Neuse River.....	Clayton.....	Johnston.....	7/20/27	Recorder
310	Flat River (below Lake).....	Bahama.....	Durham.....	12/31/25 ¹	Recorder
311	Eno River.....	Hillsboro.....	Orange.....	11/21/27	Staff
	CAPE FEAR RIVER BASIN				
401	Cape Fear River.....	Fayetteville.....	Cumberland.....	1 /1/89	Recorder
405	Deep River.....	Ramseur.....	Randolph.....	11/24/22	Recorder
406	Morgan Creek.....	Chapel Hill.....	Orange.....	1/20/23	Recorder
407	Deep River (West Fork).....	High Point.....	Guilford.....	6/14/23 ¹	Recorder
408	Cape Fear River.....	Lillington.....	Harnett.....	12/ 6/23	Recorder
410	Horsepen Creek.....	Battleground.....	Guilford.....	11/ 9/25	Recorder
411	Deep River (East Fork).....	High Point.....	Guilford.....	7/27/28	Recorder
412	Buffalo Creek (North Fork).....	Greensboro.....	Guilford.....	8/27/28	Recorder
413	Buffalo Creek (South Fork).....	Greensboro.....	Guilford.....	8/30/28	Recorder
414	Reedy Fork Creek.....	Huffine's Mill, near Greensboro.....	Guilford.....	9/ 7/28	Recorder
415	Deep River.....	Randleman.....	Randolph.....	9/ 8/28	Recorder
416	Haw River.....	Brown Summit.....	Guilford.....	10/—/28	Recorder
417	Haw River.....	Haw River.....	Alamance.....	10/—/28	Recorder

¹ Record not continuous from date of first operation.

ACTIVE STREAM GAGING STATIONS IN NORTH CAROLINA—Continued

Number	Stream	Station	County	Date Established	Type
YADKIN RIVER BASIN					
503	Yadkin River.....	North Wilkesboro.....	Wilkes.....	8/30/03 ¹	Chain
509	Fisher River.....	Dobson.....	Surry.....	9/ 1/20	Staff
510	Pee Dee River.....	Rockingham.....	Anson-Richmond.....	9/27/27	Recorder
511	Yadkin River.....	Yadkin College.....	Davidson.....	6/30/28	Recorder
512	South Yadkin River.....	Cooleemee.....	Davie.....	6/16/28	Recorder
CATAWBA RIVER BASIN					
613	Linville River.....	Branch.....	Burke.....	6/ 7/22	Staff
614	Little Sugar Creek.....	Charlotte.....	Mecklenburg.....	7/ 3/24	Recorder
615	Henry Fork River.....	Henry River.....	Burke.....	7/26/25	Recorder
BROAD RIVER BASIN					
705	Sandy Run.....	Boiling Springs.....	Cleveland.....	5/ 5/25	Staff
706	Second Broad River.....	Cliffside.....	Rutherford.....	6/30/25	Recorder
707	Broad River.....	Boiling Springs.....	Cleveland.....	6/24/25	Recorder
709	Broad River.....	Lake Lure.....	Rutherford.....	3/11/27	Recorder
NEW RIVER BASIN					
904	New River (South Fork).....	Jefferson.....	Ashe.....	10/23/24 ¹	Chain
906	New River (North Fork).....	Crumpler.....	Ashe.....	7/11/28	Chain

¹ Record not continuous from date of first operation.

Number	Stream	Station	County	Date Established	Type
FRENCH BROAD RIVER					
1101	French Broad River.....	Asheville.....	Buncombe.....	9/ 2/95	Chain
1106	Mills River (South Fork).....	Sitton.....	Henderson.....	6/ 1/04 ¹	Staff
1114	Swannanoa River.....	Swannanoa.....	Buncombe.....	5/28/07 ¹	Staff
1120	Davidson River.....	Brevard.....	Transylvania.....	12/10/20	Staff
1121	French Broad River.....	Blantyre.....	Transylvania.....	12/11/20	Chain
1122	Pigeon River.....	Crabtree.....	Haywood.....	12/16/20	Chain
1123	Pigeon River.....	Mt. Sterling.....	Haywood.....	9/18/24	Recorder
1125	French Broad River.....	Calvert.....	Transylvania.....	10/15/24	Staff
1125-A	Nolichucky River.....	Poplar.....	Mitchell.....	7/28/25	Staff
1126	Swannanoa River (North Fork).....	Black Mountain.....	Buncombe.....	1/15/26	Recorder
1127	Bee Tree Creek.....	Swannanoa.....	Buncombe.....	2/ 6/26	Recorder
1128	Mills River (South Fork).....	Pinkbeds (Pisgah Nat'l Forest).....	Henderson.....	3/ 1/26	Recorder
1129	Pigeon River.....	Hepeo.....	Haywood.....	7/26/27	Recorder
LITTLE TENNESSEE RIVER BASIN					
1201	Little Tennessee River.....	Judson.....	Swain.....	6/25/96	Staff
1202	Tuckasegee River.....	Bryson.....	Swain.....	11/ 7/97	Recorder
1207	Cullasagee Creek.....	Cullasaja.....	Macon.....	6/13/07 ¹	Staff
1211	Nantahala River.....	Almond.....	Swain.....	4/16/12 ¹	Staff
1215	Oconalufy River.....	Cherokee.....	Swain.....	1/27/21	Staff
1216	Little Tennessee River.....	Etna.....	Macon.....	1/ 7/26	Staff
1217	Cullasaja Creek.....	Highlands.....	Macon.....	12/ 8/27	Recorder
1218	Scott's Creek.....	Sylva.....	Jackson.....	5/16/28	Recorder
1219	Tuckasegee River.....	Dillsboro.....	Jackson.....	6/15/28	Staff
HIWASSEE RIVER BASIN					
1301	Hiwassee River.....	Murphy.....	Cherokee.....	6/23/96	Recorder
1303	Nottely River.....	Ranger.....	Cherokee.....	1/17/01 ²	Chain
1304	Valley River.....	Tomotla.....	Cherokee.....	6/19/04 ²	Staff

¹ Record not continuous from date of first operation.

TABLE III—CHANGES IN STREAM GAGING STATIONS OPERATED YEAR 1926-1927

Stations	Type of station	Date of Change	Remarks
STATIONS ESTABLISHED			
Broad River at Lake Lure Dam.....	Recorder.....	March 11, 1927.....	Entire cost paid
Dan River near Francisco.....	Chain.....	May 1, 1927.....	Re-established
STATIONS DISCONTINUED			
Dan River at Asbury.....	Staff.....	September 30, 1926.....	Insufficient operating funds
Dan River near Francisco.....	Chain.....	September 30, 1926.....	Insufficient operating funds
Dan River at Pine Hall.....	Chain.....	September 30, 1926.....	Insufficient operating funds
Deep River (West Fork) near High Point.....	Staff.....	September 30, 1926.....	Insufficient operating funds
Fishing Creek near Enfield N. C.....	Staff.....	September 30, 1926.....	Insufficient operating funds
Little Creek near Zebulon.....	Staff.....	September 30, 1926.....	Insufficient operating funds
Moccasin Creek at Taylor's mill near Middlesex N. C.....	Staff.....	September 30, 1926.....	Insufficient operating funds
Mills River near Mills River N. C.....	Staff.....	September 30, 1926.....	Insufficient operating funds
Mills River (South Fork) at Sitton N. C.....	Staff.....	September 30, 1926.....	Insufficient operating funds
New River (North Fork) near Warrensville, N. C.....	Chain.....	September 30, 1926.....	Insufficient operating funds
New River (South Fork) at Bowie N. C.....	Chain.....	September 30, 1926.....	Insufficient operating funds
New River (South Fork) near Jefferson.....	Chain.....	September 30, 1926.....	Insufficient operating funds
North Toe River at Spruce Pine.....	Chain.....	September 30, 1926.....	Insufficient operating funds
Swannanoa River at Biltmore, N. C.....	Staff.....	September 30, 1926.....	Insufficient operating funds
Tuckaseegee River near East Laport, N. C.....	Chain.....	September 30, 1926.....	Insufficient operating funds

54 Stations in operation at beginning of year, July 1, 1926.

16 were equipped with recorders
 38 were of the non-recording type

41 Stations were in operation at end of year, June 30, 1927
 19 were equipped with recorders
 22 were of the non-recording type

TABLE III—CHANGES IN STREAM GAGING STATIONS OPERATED YEAR 1927-1928—Continued

Stations	Type of Station	Date of Change	Coöperating Party
STATIONS ESTABLISHED			
Neuse River near Northside ¹	Recorder.....	July 27, 1927.....	Durham and Raleigh
Neuse River near Clayton.....	Recorder.....	July 29, 1927.....	Raleigh
Pigeon River near Hepco ²	Recorder.....	August 9, 1927.....	Pigeon River Power Co.
Flat River at dam near Bahama.....	Recorder.....	August 19, 1927.....	Durham
Pee Dee River at Rockingham.....	Recorder.....	September 27, 1927.....	Carolina Power and Light Co.
Eno River at Hillsboro.....	Staff.....	November 21, 1927.....	Durham
Cullasaga Creek at Highlands.....	Recorder.....	December 8, 1927.....	Highlands
Scott's Creek near Sylva.....	Recorder.....	May 16, 1928.....	Sylva Paperboard Co.
Tuckasegee River at Dillsboro.....	Staff.....	June 15, 1928.....	None
South Yadkin River at Cooleenec.....	Recorder.....	June 16, 1928.....	Carolina Power and Light Co.
Yadkin River at Yadking College.....	Recorder.....	June 30, 1928.....	Tallassee Power Co.
STATIONS DISCONTINUED			
Yadkin River near Salisbury.....	Chain.....	December 31, 1927.....	Tallassee Power Co.
Yadkin River at High Rock.....	Recorder.....	December 7, 1927.....	Tallassee Power Co.
Reedy Fork Creek near Summerfield.....	Recorder.....	June 30, 1928.....	Greensboro

41 Stations in operation at beginning of year, July 1, 1927

19 were equipped with recorders

22 were of the non-recording type

50 Stations were in operation at end of year, June 30, 1928

27 were equipped with recorders

23 were of the non-recording type

¹Originally established as chain gage station. Converted to recorder station May, 1928 with assistance of \$50.00 each from Durham and Raleigh.²Federal power permittee station.

For the next fiscal year coöperative funds from the U. S. Geological Survey and other agencies will be still further increased.

Coöperation with U. S. Geological Survey. This agency has continued to install and operate all stream gaging stations in the State under the general direction of this Division. The Survey contributed only \$2,300.00 to work in this State during the fiscal year 1927-28, but has doubled this amount for the fiscal year 1928-29.

All active stream gaging centers in the Asheville office, which is headquarters for the U. S. Geological Survey and State stream gaging personnel. Beginning November 1, 1928, an assistant engineer of the U. S. Geological Survey will move to Chapel Hill so that stations in the East may receive better attention than heretofore. This is made possible through the increased coöperative funds enabling us to employ an additional engineer.

TABLE IV—SOURCES OF FUNDS DISBURSED BY ASHEVILLE OFFICE OF U. S. G. S. COÖPERATING WITH WATER RESOURCES AND ENGINEERING DIVISION, DEPT. OF CONSERVATION AND DEVELOPMENT IN STREAM GAGING WORK IN N. C.

	Year ending June 30, 1927		Year ending June 30, 1928	
		Per Cent		Per Cent
State Appro. through Water Resources and Engineering Div.....	\$ 7,859.33	53.8	\$ 10,810.00	51.9
U. S. Geological Survey.....	3,708.92	25.4	2,300.00	11.1
War Dept.-Corps of Engineers.....	2,018.77	13.8	1,322.21	6.3
Power Companies.....	608.90	4.17	2,383.19	11.4
Municipal.....	257.48	1.76	1,451.21	6.9
Other.....	140.73	0.96	2,550.59	12.2
Grand Total.....	14,594.13	100.00	20,817.20	100.00
Other than State-Total.....	6,734.80	46.2	10,007.20	48.1
Other than U.S.G.S.—Total.....	10,885.21	74.6	18,517.20	88.9
Coöperative funds other than State and U. S.G.S.....	3,025.88	20.7	7,707.20	37.

North Carolina, on June 30, 1928, ranked about 12th in the amount of money expended for stream gaging and in the number of stations in operation, being exceeded in the South by Virginia, Tennessee, and Texas.

Coöperation with U. S. War Department. The U. S. District Engineer's office at Chattanooga has contributed about \$1,321.00 annually toward payment of gage readers salaries and field expenses connected with operation of 13 stations on streams in this State draining into the Tennessee Basin. This coöperation may cease at any time, and the Division has to stand prepared to take over this expense.

Coöperation with Municipalities. At the end of the fiscal year 1927-28 the Division had stream gaging agreements in effect with the cities of Raleigh, Charlotte, Durham, Greensboro, High Point, Asheville, and Waynesville covering the installation and operation of stations. These stations have been variously installed for water supply, sewage, and stream pollution studies.

Coöperation with Power Companies. At the end of the fiscal year 1927-28 agreements were in effect with the Carolina Power and Light Company, the Virginia Electric and Power Company, the Appalachian Electric Power Company, and the Tallassee Power Company covering the installation and operation of 7 stream gaging stations.

Specific Stream Flow Studies. Reference is made in other sections of this report to coöperative investigations in which the operation of stream gaging stations form an important part.

Requests for Stream Gaging Data. Forty, and forty-seven such requests were received and answered in the fiscal years 1926-27 and 1927-28, respectively. Often it requires several days time to get up the information requested in a single communication.

Publications. No publications on stream gaging have been issued during the year, but the location of all stations was shown on a map prepared for Economic Paper 61. The five year supplement to Bulletin 34 is in preparation and will be issued during the year 1928-29. Printing funds to meet this important compilation have been included in the budget request. Bulletin 34 contains all stream gaging data through 1923. The supplement will include all data added through 1928.

General. Due to demands for new stations and inability to obtain increased personnel, stream gaging personnel have spent an undue proportion of time in field work. As a result office work is seriously in arrears, and demands for current data cannot be met. Provision for employment of an extra office engineer is included in the requested budget for the next biennium. This is imperative if the Division is to give the prompt service required of it in furnishing current data.

2. POWER STUDIES

No field work has been undertaken on water power surveys during the past two years. The Division has published reports on the water powers of Surry and Wilkes counties and on the Deep River. Manuscript reports on the water powers of the Hiwassee, New Watauga, and Dan Rivers have been completed during the biennium or previously, and should be published in abstract during the year 1928-29. Several sales, totaling \$75.00 for these manuscript reports have been made to interested power companies and others. No large undeveloped water powers now exist in this State which have not been investigated by the Division. In consequence, future activities in water power studies should consist in publishing available data and in promoting development.

The annual compilation of power statistics for 1925 was published as Circular 16; and for 1926 and 1927 was published in abstract in "Conservation and Industry", and in full in a number of the state papers. This included developed and undeveloped water power, steam power plants, output in kilowatt hours from water and fuel, power output growth, and allied data analyzing the trend in power production and power resources of the State. The Division has continued to collect all available data relating to rural power, and it is hoped that a more energetic campaign to stimulate its development in the State will be possible during the next biennium, for which funds have been requested in the budget.

During the biennium new hydro-electric developments totalling 215,000 h. p. have been placed in service, with 90,000 h. p. more under construction. Steam power plants have been increased by 100,000 h. p. Power output has increased 34 per cent. Table V shows the present status of all projects in the State coming under the jurisdiction of the Federal Power Commission. Legislation is recommended in Appendix A whereby the fees due the State under these projects may become available to the Department.

A new power map of the State was issued in June, 1928—the most exact and elaborate ever issued by any state. Demands for this have been extensive.

3. HYDROLOGICAL STUDIES

Annual Rainfall. In addition to current compilations of stream flow data, there has been prepared during the year 1927–28 a report with maps of “Distribution of Annual Rainfall in North Carolina”, the work of the Research Assistant, F. M. Bell. Annual rainfall records from over 150 stations have been compiled and worked to a 40-year average. An isohyetal map has been prepared showing the variation in annual rainfall over the State. Temperature studies have been begun. A preliminary map containing some of the results of this study was published in Economic Paper 61.

Questions of rainfall distribution, temperature, and humidity are becoming of more and more importance in connection with resort developments and location of specialized industries. It is hoped to continue these studies and issue a comprehensive bulletin on the climatology of the State during the next biennium if funds requested are granted.

Evaporation. The water evaporation stations on Lakes Tallassee and Michie and the land station at Chapel Hill have continued to be operated. These are the only standard evaporation stations now in operation in the South and a number of requests for data have been received. Both water stations are maintained in coöperation with local interests.

Durham Investigation. The detailed study of stream flow, rainfall, evaporation, and silting undertaken in coöperation with the City of Durham lagged during the year 1927–28 due to lack of personnel. Demands by the City for data could be met only in part. The Forestry Division began a vegetation study to correlate with the data being collected by the Water Resources Division.

High Point Study. The City of High Point has requested an intensive study on its watershed analogous to that at Durham. The Division has been unable to accede to the request due to lack of personnel, although the City will supply all instrumental equipment needed.

Greenville Bridge Study. An exhaustive report was prepared by the Division at the request of the State Highway Commission regarding backwater conditions above a new bridge over the Tar River at Greenville. The report resulted in setting aside an injunction which had been instituted against the Commission. The Chief Bridge Engineer of the State Highway Commission writes regarding this report:

As a result of your work we feel confident that future floods will pass our highway bridge without damage to the water plant of the City of Greenville. As you know, there was a serious question as to whether or not we should lengthen our bridge. Had it not been for the result obtained in your study of this situation the State would have had to expend approximately \$40,000.00.

The coöperation that you have extended us in this and other matters has been of great value to the Commission and I appreciate it very much indeed.

It appears that by this one investigation the State has been saved a sum greater than the entire annual appropriation to the Division.*

*In September 1928 the second greatest flood of record passed under the new bridge and the previous investigations of the Division were fully substantiated by actual events, there being no damage from backwater due to bridge.

TABLE V—FEDERAL POWER PROJECTS—NORTH CAROLINA
November 1, 1928

Project No.	Company	River	Primary H. P.	Installed H. P.	Status
432	Carolina Power and Light Co.	Big Pigeon.....	23,760	105,000	License (50 year) issued 11/23/26
532	Thompson Power Co.	Hiwassee.....	110,000	259,000	Application withdrawn 12/11/26
542	Central Power Co.	New and Reddies.....	60,000	80,000	Rejected 9/15/26
575	Eastern States Development Co.	New and Fisher.....	200,000	300,000	Rejected 9/15/26
667	Parker, J. A.	Cape Fear.....			Rejected 12/14/26
693	Highlands, Town of	Cullasagee.....	185	600	License (50 year) issued 7/19/26
715	Shuford and Laxton.....	Wilson Creek.....	3,072	5,028	Permit (3 year) issued 11/16/26
718	Federal Power Co. of Tennessee.....	Nolichucky-Toe.....	27,800	72,000	Conflicts with 732
902	Virginia-Carolina Power Co. of Va.	Roanoke.....		50,000	Preliminary permit pending
916	Virginia-Carolina Power Co. of N. C. site A.	Roanoke.....	13,800	87,000	Preliminary permit pending
916	Virginia-Carolina Power Co. of N. C. site B.	Roanoke.....	9,400	56,000	Preliminary permit pending
.....	Buggs Island.....	Roanoke.....	13,800	87,000	Preliminary permit pending

Miscellaneous Hydrological Studies. Reference is made elsewhere to several hydrological studies carried on under other sub-divisions of this report. Several of these are greatly delayed due to lack of personnel and funds. The requests for special hydrological investigations for other State departments and from municipalities are increasing. They form an important and necessary obligation upon the Division. It is of the utmost urgency that for the next biennium the Division be prepared to meet these demands more effectively and on a more efficient scale than has been possible in the past. An item of about \$3,000.00 annually has been included in the recommended budget for employment of additional personnel and for travel expense on this work.

4. COASTS, PORTS AND WATERWAYS

Coastal Investigations. At the request of various interests on the coast and in the eastern section of the State, surveys have been made during the summers of 1927 and 1928 on the beaches at Wrightsville, Carolina, Morehead, and Nags Head. Base lines have been run and accurately tied into the triangulation system of the U. S. Coast and Geodetic Survey. Cross sections of the beaches have been made and topography taken. These surveys will enable us to measure from time to time the changes which are going on along our beaches, and indicate the best and most satisfactory methods of preventing the erosion which is assuming serious proportions at several points. A party was sent to the coast to make measurements of the effects of the severe storm of December, 1927.

The Division has been unable to carry out the provisions of Chapter 264 of the Public Laws of 1925, directing an investigation of the feasibility of placing a dam or dams across Roanoke Sound to open inlets and increase the salinity of the water in Albemarle Sound, due to the fact that the Act carried no funds.* However, what is urgently needed is a general comprehensive investigation of the entire coastal region with reference to improvement of the fishing industry, opening inlets, salinity of inland water, navigation features, and coastal protection.

A complete plan for this study has been outlined and has received enthusiastic endorsement by the authorities of the American Shore and Beach Preservation Association which is associated with the National Research Council. The results of our coastal studies, the policies of the State in relation thereto, and plans for future investigations were presented to the Association at the Jacksonville meeting in November, 1927, in papers by the Director and the Chief Engineer. These papers aroused a good deal of interest, were widely copied in the Florida and North Carolina newspapers, and were printed in the proceedings of the Association. A marked copy has been sent to each Board Member. Largely as a result of the activities of the Division in this work the next annual meeting of the Association is to be held at Wilmington, N. C., November 26th and 27th, 1928.

Port and Harbor Studies. The Division should have facilities to assist other state agencies in engineering advice relative to development of ports and

*A reconnaissance survey was undertaken during the summer of 1928.

harbors and inland waterways. It is felt that engineering service of this character should be more in evidence in future investigations of water transportation in the State.

The Division believes that one of its most important activities during the next biennium should be concerned with these coastal, port, and waterway studies. The necessity for the coastal work is outlined in detail in the papers referred to above. A request for about \$10,000.00 annually for the two year period has been placed in the recommended budget, with the expectation that in addition half that amount should be raised from local sources. The total sum of \$30,000.00 would enable a detailed study to be made with a report to the next Legislature as to feasibility and cost of various remedial measures proposed.

5. STREAM SANITATION AND CONSERVATION

In December, 1927, an agreement was entered into by the Department of Conservation and Development and the State Board of Health whereby the joint interests of these two state agencies in stream pollution was to be correlated through the medium of a Stream Sanitation and Conservation Committee, which was duly formed. The Chairman and Secretary are respectively the Secretary of the State Board of Health and the Director of the Department of Conservation and Development. The chief engineers of each department are the other members.

This committee has correlated the many important phases of stream pollution which are arising with the urbanization and industrialization of the State, so that there will be no conflict of interest or duplication of work. In general all analytical and sanitary studies are to be conducted by the Engineering Division of the State Board of Health, and all hydrological, surveying, and mapping work by the Water Resources and Engineering Division of the Department of Conservation and Development.

Roanoke Rapids Study. Largely at the request of the Fisheries Division in connection with reestablishment of a Rock Hatchery at Weldon, a rather detailed preliminary report was rendered on stream pollution caused by wastes from the mills at Roanoke Rapids. It was found that pollution due to this cause had materially decreased in recent years and would still further decrease soon, due to added recovery equipment to be installed by the mills.

Scott's Creek Study. The erection of a new paper-board mill near Sylva gave concern as to the effect of its wastes upon fish life and the creation of a nuisance in the Tuckasegee River. After a conference with officials of the company, a joint study of the problem was undertaken and is now in process. The company contributed \$1,000.00 to the erection of a stream gaging station on Scott's Creek. Engineers and chemists from the State Board of Health are now engaged in field studies.

Paper Mill Agreement. Due to the serious nature of paper mill wastes upon fish life and in injuriously affecting waters used for municipal or industrial water supply, an agreement has been consummated between the Stream Sanitation and Conservation Committee and all of the paper and pulp interests in the State, whereby joint investigations are to be undertaken to determine methods for reducing the injurious effects of such wastes.*

*The first study under this agreement was begun in September, 1928, on the Pigeon river at and below Canton, N. C.

Hickory Water Supply Study. Studies were begun in June, 1928, to determine the effect of the new Oxford Shoals reservoir of the Duke Power Company upon possible pollution of the Hickory Water Supply by sewage which is discharged below the water works intake.

River Investigations. Comprehensive sanitary surveys are being undertaken on the Neuse, Haw, Catawba, and Tar rivers.

The Water Resources and Engineering Division is installing stream gaging stations, making hydrological studies, and preparing drainage maps of each county, in connection with all of the studies enumerated above. Also estimates of probable minimum and average flows are being made for 150 streams at points of sewage discharge in connection with studies by the State Board of Health. Preparation of these estimates alone will require about six weeks continuous work of one engineer. All of this work was not contemplated on any such scale when the present budget was adopted, and the Division has consequently been unable to meet satisfactorily the demands for this service. An item of \$8,000.00 annually, included in the budget request for the next biennium to cover this, includes an additional engineer, new gaging stations, and travel expenses.

6. CHEMICAL WATER ANALYSIS

The Director made arrangements in April, 1927, for Dr. E. E. Randolph, of State College, to analyze samples of water during the summer with a view toward issuing a Bulletin on Quality of Waters. The Division had been coöperating with the U. S. Geological Survey previously in such a study, and 60 analyses had been made. During the summer of 1927 the Division arranged for the collection of approximately 100 additional samples, of which 70 were analyzed by Dr. Randolph. In addition, the Division has collected 51 miscellaneous samples from various sources, 20 of them previously made by Dr. Randolph. All analyses, totaling 181, have been tabulated, checked, revised, and segregated according to the principal divisions of the State. Text of a bulletin was prepared. Maps showing location of sampling points, rainfall distribution, location of stream gaging stations, and temperature distribution for the State were made and sent to the U. S. Geological Survey for printing. The Bulletin went to press in March and was available for distribution in July. This Bulletin has represented an enormous amount of labor by the small staff of the Division, and the Assistant Engineer, Charles E. Ray, Jr., who has been responsible for all detailed compilations and the general arrangement of the Bulletin. He put in many hours of overtime in order to get the Bulletin completed.

The Bulletin acknowledgedly represents only a small part of surface and underground water analyses needed by industries and municipalities, although advance data from it have been supplied in response to a number of inquiries, and it has already been of aid in attracting new industries. Nevertheless, requests have been received for analyses from a number of sources for which no data exists. Hence collection of samples is continuing, and additional analyses are being made slowly by the State Board of Health. Many more analyses are needed, not only from hitherto untouched sources, but also from sources already analyzed, but under varying conditions of stream flow.

In the interests of efficiency, arrangements have been made with the State Board of Health, where laboratories and personnel exist for conducting accurate water analyses, whereby the budget of that Bureau will include provision for

the next biennium for personnel, supplies, etc., sufficient to meet the needs of this Division for prosecuting an expanded program of water analysis. The Division is reciprocating by providing funds in its budget to conduct hydrographic investigations needed by the State Board of Health. Thus each state agency is arranging to support the other for a mutual exchange of services that each is best able to render. Assuming the State Board of Health will be successful in obtaining funds for analytical services in connection with water analyses, the Division requests only \$1,100.00 annually for the next biennium to pay for transportation charges on samples and for printing a water analysis bulletin.

7. DRAINAGE

The Drainage Acts of the State place certain responsibilities as to origination of districts upon the Department. These Acts have not been successful in preventing some unfortunate attempts in the creation of districts, nor is there proper provision for maintenance. The law places the responsibility for approval of Drainage Engineers upon the Department. What should be approved is the *plan* and not the engineer. Pending changes in the law to effect this, the Division has predicated approval of the engineer upon submission of satisfactory plans. This has been put into effect recently in the case of Rowan County Drainage District No. 9, and resulted in material assistance to the State Highway Commission in providing for new bridges over drainage structures.

A thorough analysis of all existing drainage districts should be made, and engineering assistance rendered where possible. A number of amendments to the Drainage Act are recommended in Appendix B, giving the Department closer scrutiny over Drainage District affairs. There is no item in the present budget covering such studies or assistance, and about \$1,000.00 annually is included in the next budget for this purpose. Recommended amendments to the Drainage Acts provide for reimbursement to the Division for supervision in connection with new projects.

8. UNDERGROUND WATER INVESTIGATIONS

In spite of urgent representations from interested parties the request of the Division for appropriations for an underground water survey of the coastal plain area was not met by the last Legislature. More than one municipality has been in difficulties in the ground water supply during the past two years. The Division has rendered assistance, in coöperation with the U. S. Geological Survey, in connection with increase in chlorides in the New Bern wells. For industrial and urban growth in the east a thorough study of the underground water resources of the region is imperative. Arrangements have been made with the U. S. Geological Survey whereby if the State will contribute a total of \$8,000.00 for the next biennium the U. S. Geological Survey will contribute a total of \$6,000.00 and undertake a study of the underground waters in coöperation with the Division. Request for items to meet this offer has been made in the recommended budget.

Legislation relative to the drilling, reporting, and operation of wells has been requested by the well drillers of the State. Appendix C outlines recommended legislation for these purposes.

9. MAPPING

State Lakes and Parks. During the year 1927-28 field work was completed and a map of White Lake was made for the Forestry Division. The map shows all structures about or in the lake, roads, etc., and is to be used for regulatory purposes. Field work and detailed map were completed showing the State Park at Fort Macon. The Forestry Division desires all state-owned lakes to be accurately mapped.* In addition surveys should be made of State game preserves, state-owned swamp lands, etc. The State has lost great future values in the unregulated disposition of large areas of coastal land, and the Department should in the near future attempt to reserve appropriate lands in the east as public resort and recreation areas. The last standard U. S. Geological Survey map of the State was issued in 1921. A revised map showing all lakes, reservoirs, state and national forests, etc., should be prepared, together with a Gazetteer of Inland Waters giving all stream and lake names, length, location, area, etc. For surveys and mapping of this character an annual item of about \$3,000.00 is recommended in the next budget.

A real handicap in the efficient development of the State is due to lack of completion of the U. S. Geological Survey topographic map of North Carolina. Expansion of cities, location of highways, development of airports, development of coastal areas, geological investigations, drainage projects, water power developments, forestry and park studies, and countless similar expansions of industrial and urban growth in the State is seriously delayed and curtailed by lack of accurate maps. This State ranks 31 among the states of the Union in per cent of area mapped, and has less area mapped than any other South Atlantic state except Florida. Only 36 per cent of North Carolina is mapped. Virginia has already over 90 per cent of its area mapped, and will have 100 per cent within the year. The U. S. Geological Survey meets state contributions for mapping on a fifty-fifty basis. To complete the topographic map of North Carolina would cost about \$500,000.00, or \$250,000.00 each from Federal and State sources. A ten year program on the part of the State is suggested, whereby \$25,000.00 would be spent annually for ten years. Outline of suggested legislation to effect this is contained in Appendix D.

The Division has continued adding to its collection of maps relating to the State, the most important additions during the year being the surveys of Tennessee River in North Carolina made by the War Department. About \$100.00 worth of those maps have been donated to the Division files by authorization of the Chief of Engineers. The Division has also acquired the new airways maps of the Department of Commerce.

10. AIRPORTS

An important new activity of the Division undertaken during the past six months has been in assisting in the development of municipal airports. The Division was of considerable assistance in having a Class A Weather Bureau station established at the Friendship Airport near Greensboro, and is coöperating with various interests in the State relative to airport construction. It is believed that a formal recognition of this phase of activity should be made, since with the rapidly increasing use of air service, numerous municipalities in the State are desirous of having airports. This work should be coördinated by the Division, standard airport regulations of the Department of Commerce should

*Surveys are now (October, 1928) under way to complete maps of Jones and Salters lakes.

be insisted upon, municipalities should be advised as to requirements for different classes of airports, and assistance should be rendered those who are promoting a proper development of this activity in trying to change the municipal Finance Act so that municipalities may issue bonds for airport construction under supervision of the Department. In short, there is a vast field of usefulness here which is just breaking and which the Division desires to cultivate energetically. It is imperative for proper development of air service in the State, both by land and water, that the Department through this Division undertake the following activities:

a. Promote proper location of airports, and prevent improper location or financing.

b. Correlate the activities of the Department of Commerce, air mail service, municipalities, private groups, engineering associations, and others to the end that airport development in the State follow sound and conservative lines.

c. Act as advisor to municipalities to see that airport plans conform to regulations of the Department of Commerce.

To carry out these recommended activities an annual item of \$6,500.00 is contained in the recommended budget. This includes part of the cost of an airplane, recommended for joint use of the Forestry and Water Resources and Engineering Division.

WATER RESOURCES DIVISION RECEIPTS AND DISBURSEMENTS BIENNIAL
PERIOD ENDING JUNE 30, 1928

RECEIPTS

State Appropriation.....	\$ 38,803.50
Private Coöperation.....	4,846.21
Sale of Publications.....	273.79
Refunds.....	43.89
Miscellaneous.....	152.19
Total Receipts.....	\$ 44,119.58

DISBURSEMENTS

Personal Services—Professional and Clerical.....	\$ 29,093.44
Supplies and Materials.....	1,884.43
Postage, Telephone and Express.....	858.96
Travel.....	5,397.38
Printing.....	643.36
Auto up-keep.....	522.83
Repairs to equipment.....	132.03
General.....	1,135.25
Equipment.....	3,205.75
Additions and Betterments.....	310.47
Sesquicentennial Exposition.....	258.00
Total Disbursements.....	\$ 43,441.90
BALANCE—Private Funds for Stream Gaging Work.....	\$ 677.68

DIVISION OF MINERAL RESOURCES

H. J. BRYSON, *State Geologist*
GLADYS PRITCHETT, *Stenographer*

The accomplishments of the Division of Mineral Resources have been rather favorable in spite of the fact that the work was limited due to the lack of funds. During the past two years the work of collecting and indexing statistics of the State's mineral production has been carried on in coöperation with the Bureau of Census. Answers to inquiries in regard to the minerals and mineral prospects have been given and 340 mineral specimens have been received at this office and reported on.

In addition to the above routine service, special investigations and reports of unusual interest were made as follows:

A complete report was made on the marl deposits along Trent River in Jones County. The investigation revealed large and valuable deposits. Dr. E. E. Randolph of State College made the necessary chemical analyses. As a direct result of these investigations a \$3,000,000 Portland Cement Plant is under consideration.

An extensive survey was made of the feldspar deposits in Yancey County. The investigation, which was very satisfactory, lead to the establishment of a new feldspar grinding plant. The entire expenditure is about \$350,000.

Preliminary surveys of the amphibole asbestos deposits revealed some very large and valuable deposits. Two plants have already been established and two others are under consideration. This State will be, in the near future, a very important asbestos producing State.

In company with R. B. Rogers of the Greensboro Chamber of Commerce, a survey was made of the white ware industry of the States of Ohio, West Virginia and Pennsylvania. The survey revealed that 11 plants were buying exclusively the North Carolina kaolin clays and 17, the North Carolina feldspars. It is probable that within the near future one or more white ware plants will be established in this State. The survey created a great deal of interest in the North Carolina deposits.

A preliminary report was made on gold and copper deposits in Randolph, Rowan and Halifax counties. These investigations showed deposits which may be worked commercially within the next few months. Engineers are now making thorough and complete reports to determine the real value.

The State Geologist, in company with Dr. J. L. Stuckey, Professor of Geology, State College, made a short survey of the mica, feldspar and kaolin industries of this State. The condition of these industries, as the survey showed, was possibly the best in the history of the State. Three new feldspar plants have been built, five mica recovery plants, one mica grinding plant, and new machinery installed in two clay washing plants, in the past two years.

In company with Professor A. F. Greaves-Walker, Ceramic Engineer, State College, a short survey was made of the principal brick and tile producing centers of the State. The condition of this industry is very good. One plant now produces a buff-face brick. A new tile plant has been opened near Winston-Salem.

Most of this year has been spent in cataloguing the mineral deposits by counties. Several trips were made through the mineral districts for the purpose of checking the chief deposits. The results of these examinations are to be published soon by the Statistical Division.

Considerable work was done on the pyrophyllite deposits of Moore County. A great many letters asking for information on the deposits near Glendon were received. A preliminary report was compiled and sent to those interested. A new plant is being constructed by the North Carolina Tale and Crayon Company at Glendon. Another is being considered at Staley in Randolph county.

A complete summary of the mining industry in North Carolina has been prepared by the Geologist and is printed in a series of articles in *Conservation and Industry*, the Departmental publication.

Reports on the marble deposits were compiled and sent out. A new plant is now under construction which, when completed, will produce building stone, terrazzo material, crushed stone, lime and possibly other materials. The plant, when completed, will cost close to \$200,000.

Economic Paper No. 58, "Oil-Prospecting Well Near Havelock, North Carolina", by Wendell C. Mansfield, was published. The information given in this publication is of great value to the State.

Economic Paper No. 59, "Oil-Bearing Shales of Deep River Valley", by Dr. Frank C. Vibrandt, Industrial Chemist, University of North Carolina, was published. Since the publication of this report considerable interest has been aroused in the low temperature distillation of the shales and coal of the Deep River Valley.

Economic Paper No. 60, "The Mineral Industry in North Carolina during 1924-1925" was prepared. This publication contains the statistics of the mineral production, list of mineral producers, location of plants, and list of the chief economic minerals found in the State. Practically all of the 1,000 copies have been distributed to parties interested in North Carolina minerals.

Economic Paper No. 62, "The Mineral Industry in North Carolina during 1926" was also prepared. Nearly 1,000 copies have already been distributed.

Educational Series No. 1, "The Story of the Geologic Making of North Carolina", was written and printed during the past summer. This is the first time that such a publication has been issued on the geology of North Carolina. It is being distributed to the public on application, to students in high schools and colleges and to the teachers of science in the public schools.

Bulletin No. 37, "The Pyrophyllite Deposits of North Carolina", is now on the press. This publication was prepared by Dr. J. L. Stuckey, Professor of Geology at State College. This bulletin is the only complete report on such materials. It should be of great value to those interested in pyrophyllite.

An appropriation for a survey of the underground water resources of North Carolina by the Division of Water Resources in coöperation with the Division of Mineral Resources has been proposed. Such a survey is needed because individuals and towns inquire from this Department for information in regard to the kind of subterranean water they may tap while boring a deep well. At present, to answer such inquiries, it is a matter of more or less guess work based on experience of those who have bored in that particular locality. A proposed bill has been drafted which reads as follows: "A bill to regulate the drilling and operation of wells and test-holes and in certain cases to provide

for the plugging of the same to prevent unnecessary waste or depletion or contamination or injury of the water, oil, gas and other underground mineral resources of the State hereinafter mentioned. Also, to provide well drillers and municipalities concerned with, and depending on, wells for their water supply with reliable information concerning the most favorable location for deep wells". The passage of such a bill would be of great value to well drillers. It would also prevent waste of underground water from the many flowing wells located in the coastal plain.

An appropriation should be granted to publish a reliable geological map of the State. Such a map has been prepared and should be printed at an early date.

Reports on the feldspar deposits should be made. This State produces about 52 per cent of that consumed in the United States but no reliable information is available for distribution. Also reports should be made on the kyanite, asbestos and sand and gravel deposits of the State. In order to prepare these publications a substantial increase in the appropriation for this Division should be made.

The increase in the total value of the mineral production during the last biennium has been something over two million dollars. Two or three of the largest mineral propositions under development in this State have been the direct result of information given by this Department.

A total of \$37,500 is the estimate of needs for the coming biennial period and reported to the Budget Commission.

DIVISION OF MINERAL RESOURCES

RECEIPTS AND DISBURSEMENTS, BIENNIAL PERIOD ENDING JUNE 30, 1928

RECEIPTS

State Appropriation.....	\$ 11,551.27
Private coöperation.....	182.78
Sale of Publications.....	34.70
Miscellaneous.....	1.20
Total Receipts.....	\$ 11,769.95

DISBURSEMENTS

Personal Services—Professional and Clerical.....	\$ 7,236.89
Supplies and Materials.....	118.35
Postage, Telephone and Express.....	71.61
Travel Expenses.....	3,464.76
Printing.....	412.92
Gas.....	3.00
General.....	64.94
Equipment.....	134.76
Sesquicentennial Exposition.....	85.00
Total Disbursements.....	\$ 11,592.23
BALANCE ON HAND.....	\$ 177.72

DIVISION OF COMMERCE AND INDUSTRY

PARK MATHEWSON, *Statistician and Assistant Director in Charge*
MABLE DUKE, *Stenographer-Clerk*

The full value and importance to the State of North Carolina of the colossal development of its commerce and industry has been more fully appreciated within the State, as well as over the country at large, since this Department's Division of Commerce and Industry has, in the last biennium, collected the full data and figures of the State's resources.

Census of Manufactures

The inventory of the output of 3,008 of the larger manufacturers of the State, just completed in conjunction with the Bureau of Census at Washington, shows the immense value of the goods produced in these North Carolina establishments totaling \$1,154,617,636, a sum greater than the Country's National debt previous to the World War and almost three times the amount in dollars that North Carolina produced in 1927 in natural resources by agriculture, forest products, minerals and commercial fisheries combined—\$411,000,000.

Interdependence of Industry and Agriculture

Industry should be regarded as an equal partner with natural resources as neither one can fully or profitably function without the success of the other, and each can best advance and profit through their mutual co-development. Research and statistics are necessary to balanced development.

Making Dependable Statistics Available

Aside from the statistics from Washington, and the limited information issued through other North Carolina departments, little comprehensive or reliable statistics covering the resources and industry of the State were available when this Division took up the task of collecting and collating them.

Much has been accomplished on this work and much remains to be done. Besides the very broad foundation of the State's facts and figures, which has been laid, many current activities, data and reports have been covered in the detailed description of each activity and function of this Division as given later in this report.

Many local and State-wide surveys have been made by this Division covering industry by locations, classes and in general, as well as goods imported into the State, and other data of immediate as well as permanent value have been developed and released where it would be of service, as hereafter enumerated.

Promoting North Carolina Industries

Where feasible, all information and statistics have been used to promote the existing as well as new industries of the State. Gratifying success has been accomplished, in coöperation with the industrial and commercial organizations, in expanding existing establishments and obtaining new ones. Some very large new industries have been located in North Carolina during this period in the obtaining of which this Department has had an important share. Included in this expansion are many new units added to present industries besides large Rayon companies and other industries which have located in North Carolina.

State-wide Statistical Data Gathered

Figures of extreme value to the State Government, the local trade bodies, the counties and cities of the State, as well as individual industries, merchants and persons interested, have been developed in the Census of Manufactures, 1927.

This census of business facts about the industries of the States has heretofore been gathered from Washington by the Federal Bureau of Census, and released in the second year following. The present Census in North Carolina has been taken by the Department of Conservation and Development through its Commerce and Industry Division and assisted by an expert lent from Washington. This State is the only one, with the exception of Massachusetts, to undertake this work which it expects to finish and have the total figures for North Carolina available in October, 1928, or many months before final figures on other states are released by the Census Bureau at Washington.

County Data for the First Time

In addition to the statistics by industries for the State, this Department has codified all these figures by counties, this being the first time such county data have been made available in any state and this information is proving of the utmost value and interest to each county of the state.

Foreign and Domestic Commerce

The coöperative office of the Bureau of Foreign and Domestic Commerce maintained at Raleigh in this Department has proved of great service to firms in North Carolina which are interested in export and import activities. Some seventy-five establishments have been added to this list in North Carolina in 1928 through the work of this Department. This service not only covers the export manufacturers but also those firms interested in domestic commerce, including the jobbers and retail merchants. Some five thousand North Carolina retailers alone were served by this local bureau in 1928.

State Chamber of Commerce Functions

The Division of Commerce and Industry has functioned, as far as possible with its limited personnel and funds available, as a North Carolina Chamber of Commerce for the reason that no such body is functioning in the State. It is believed that this service could be profitably expanded to function in this way and obviate the duplication of effort.

This Department adequately serves in furnishing unbiased and reliable State-wide facts and figures to inquirers within or without the State; in contacting and coöperating with trade bodies, universities and in State-wide movements; forming a liaison with other State and National governments; issuing State-wide promotional and informative information and literature previously listed.

The surveys, investigations and reports as developed, written and issued by the Department have been entirely handled by the personnel of the Department, with the exception of one U. S. Census Bureau employee assigned by the Federal Government for their check-up on the Census of Manufactures taken by this State Department. The savings by the Department in engineering and statistical expense over estimates of cost on one report alone, if made by outside experts, was in the neighborhood of \$10,000.

Activities of the Commerce and Industry Division

1. Making surveys of natural, industrial and commercial resources of the State.
2. Promoting conservation and development of such resources.
3. Coördinating existing investigations and agencies for conservation and development.
4. Collecting, classifying and writing up facts from investigations and other agencies for use of general public.
5. Studies of natural advantages for development opportunities and utilization of resources.
6. Setting forth the natural, economic, industrial and commercial advantages of the State.
7. Promoting industrial and commercial development of State by personal advice and information.
8. Writing books, pamphlets, articles and news items for disseminating its information.
9. Maintaining trade files for public reference.
10. Coöperating with Colleges and Universities, Chambers of Commerce, Merchants Associations and other trade bodies.
11. Promoting State-wide projects, along the lines of a State Chamber of Commerce.
12. Development of industry and commerce by personal contacts with trade bodies, meetings, expositions, etc.
13. Conferring with callers at the Department on information covering the State.
14. Coöperating with the Bureaus of Census and of Foreign and Domestic Commerce of the U. S. Department of Commerce.
15. Pamphlets and books issued by the Department and prepared in this Division are:

North Carolina's Progress and Prosperity

North Carolina Facts and Figures (1927-1928, three editions)

Analysis of North Carolina Taxes and Debts; What They Are and What They Have Bought

North Carolina Industrial Directory

North Carolina A Good Place to Live

North Carolina Resources and Industry

FACTS AND FIGURES FOR 1928

STATE POPULATION 1928—2,938,000

Climate Extent

North Carolina lies on the same parallel of latitude as the central Mediterranean basin, in climate, the most favored region on the globe. Its death rate is lower than the average for all of the United States and its birth rate is the highest. Latest U. S. Census shows but three-tenths of one per cent foreign born in State. Its trees range from the tropical palmetto to the firs of the far North. Destructive storms are practically unknown.

Waters

An Atlantic shore line of three hundred miles forms the eastern boundary of the State. North Carolina contains the greatest water area, and playgrounds of any state.

Mountains

Within a radius of fifty miles of one North Carolina city there are more than: Thirty mountain peaks, all higher than Mount Washington, N. H. Mount Mitchell, highest peak in North Carolina, or east of the Mississippi, overlooks sixty-four peaks over 6,000 feet high. The Great Smokies National Park, to cost over \$10,000,000, is located here in the Appalachian Mountains. Trees, shrubs and animals of the Canada climate are native here; the mountain waters are among the purest known.

Education

The University of North Carolina, founded in 1789, is the oldest State University in America. The State also maintains the State College of Agriculture and Engineering and four other colleges for white and six for colored. There are also thirty-two denominational or privately operated colleges for whites and seven for colored in North Carolina. The State leads the South in education; spent 35 million on public schools in 1926, 34 per cent for new schools, leading the United States in the latter, with New York second. Duke University at Durham, N. C., has one of the greatest endowments of any American College.

Wealth

North Carolina's property value is estimated to exceed five billion dollars; (681 million in 1900; 1,685 million, 1910; 4,543 million, 1926). Federal taxes paid U. S. Government in 1928 by North Carolina, \$225,315,303.53; preceded only by New York and Pennsylvania. The State owns property valued at 77 million dollars over and above its obligations. Lowest tax rate (but one) in U. S., per capita for current State maintenance.

Resources in state and national banks in North Carolina increased from one hundred and fifty million dollars in 1914 to five hundred and fifty million dollars in 1928—a gain of 370 per cent in 14 years. The banking resources of the United States increased slightly more than 100 per cent in the last 20 years. In real property and improvements the increase per capita wealth during the last ten year census period was as follows:

North Carolina.....	Increase 238 per cent
United States.....	Increase 61 per cent

Transportation

Hard-surfaced State roads connect practically every county seat and principal city in North Carolina, over 7,500 miles of State Highways; the State spent more on highways in 1926 than any other in the South; \$125,000,000 in five years. The State Highway Department built an average of 1.54 miles of hard-surfaced roads and 2.4 miles of other dependable roads for every working day in 1927. State highways are financed, built and maintained out of revenue from automobile license and gas taxes, alone. Three national systems, three southern trunk lines, and 46 shortline railways cover the State, supplemented by most comprehensive bus and motor freight systems. The water borne commerce and facilities are growing.

Water Power

North Carolina ranks fourth in the United States, in water power development. In the Southern States it ranks first in output of power plants 2,081,400,000 kilowatt hours. The installed capacity of power plants and units under construction amount to 1,262,615 horse power; 85 per cent of counties served by high-tension lines.

Industry

North Carolina has (estimated) over one billion and a quarter of dollars capital invested in manufacturing establishments, 68 million in 1900; 217 million in 1910; 669 million in 1920—U. S. Census. Three thousand of its larger factories reported an annual output of \$1,154,617,636 in 1927, (216 million 1910; 951 million 1925), U. S. Census. North Carolina led every Southern State in the number of mill and factory wage earners (1925) and in 1927 employed 204,767 workers, whose total annual wages amounted to \$158,287,197. North Carolina led all Southern States in values added to the raw materials by manufactures; (Census 1925) North Carolina, \$499,727,125, (1927, \$592,531,353); Texas, \$392,808,607; Maryland, \$357,660,398; Virginia, \$274,199,597; Georgia, \$249,501,036.

North Carolina Leads: In the South in the number of furniture factories and value of products; it is first in the United States in the manufacture of wooden bed room furniture; it leads all Southern States in capital invested; number of operatives employed; variety of products; and (except Texas), value of the annual output of all its factories.

North Carolina has practically inexhaustible supply of trained and intelligent white labor, as well as permanently ample native colored help for the heavy work performed in other sections by low-grade foreign labor.

North Carolina production 1927 by ten leading industries was:

1. Textiles and products.....	\$425,437,522
2. Tobacco products.....	413,274,114
3. Furniture.....	53,551,221
4. Lumber and plaster mills.....	53,189,652
5. Fertilizer.....	18,293,687
6. Flour and meal.....	17,847,452
7. Cottonseed production.....	17,612,879
8. Leather, cured.....	16,405,354
9. R. R. car construction.....	14,447,433
10. Printing and publishing.....	12,259,226

Leads

North Carolina ranks first in tobacco manufacture, has the largest hosiery mills, towel factory, overalls factory, and second largest aluminum reduction plant in the world. It has the largest denim mill, damask mills, underwear factory and pulp paper mill in the United States. More tobacco products made in one North Carolina city than any other in the world.

North Carolina has more cotton mills than any State in the Union; is second in the value of cotton manufactures; first in the number of spindle hours; more mills that dye and finish own products than any other Southern state. Its textile mills consume 50 per cent more bales of cotton than are grown in the State with a total value of all textile products approaching half a billion dollars.

Agriculture

Fourth State. In 1927 North Carolina ranked fourth in value per acre of the 22 important farm crops of the United States, (\$45.43); it ranked sixth in total value of same, (\$314,596,000), exceeded only by Texas, Iowa, Nebraska, Illinois and Kansas. North Carolina's diversity of farming is shown in the accompanying figures: North Carolina crops, official rank by U. S., 1927, *First*, tobacco, \$111,550,000. *Second*, peanuts, \$7,875,000. Soy beans, \$397,000. Sweet potatoes, \$8,117,000. Early Irish potatoes, \$7,182,000. *Third*, cow peas \$1,246,000. Cucumbers, \$688,000. *Fifth*, sorghum cane for syrup, \$2,236,000. *Sixth*, green peas, \$468,000. Snap beans for table \$728,000. *Seventh*, lettuce, \$785,000. Cotton (lint alone) \$83,900,000. Cotton seed, \$14,200,000. North Carolina produced more pounds of tobacco in 1927 than the next three states, in rank of production; it led in car lot shipment of strawberries.

Forest Products

North Carolina produced over \$53,000,000 forest products in 1927. The South produces 50 per cent of the nation's lumber, and Western North Carolina's hardwood forests, and Eastern North Carolina's pine and gum timberlands are among the richest in supplies of lumber in the eastern half of the United States.

Minerals

North Carolina ranks first in the United States in number (284) of native minerals and in the value and quantity of scrap mica (40 per cent of the U. S.) and feldspar (52 per cent of U. S.) produced and in pyrophyllite and residual kaolin clay. Value of mica is 37 per cent of total production in United States; it ranks second in the production of copper in Southern States, and has largest feldspar mine and open-face granite quarry in the world.

Game

Wild fowl and game of all kinds abound. Leading wintering ground of migratory wildfowl on Atlantic coast. Sea food, trout, bass are abundant.

Commercial Fisheries

North Carolina's enormous fresh and salt water sounds and lakes, over 3,600 square miles, afford some of the finest fish and shell-fish grounds in the United States.

Homes

North Carolina leads the Union in the per cent of debt-free homes. More than four-fifths of its home owners have no such debt thereon.

Opportunity

North Carolina offers today opportunities greater than those of any state in the Union. Its natural resources are the most varied in the United States. Its population provides sufficient skilled and common labor for unlimited industry and its proximity to the leading markets assures a ready disposal of goods or crops. In climate and education and comfort of living it is not excelled.

It is correctly called "The Evenly Balanced State," the "Leader of the New South".

DIVISION OF PUBLIC RELATIONS

PAUL KELLY, *Manager*

MRS. MINA STONE, *Stenographer-Clerk*

When this Division began to function under its present manager in November, 1926, a work that had been inactive for several months was resumed. Because of this fact and the rather limited field of activities being covered by the Department at that time, it was necessary to outline a new program of operation.

At that time there were only three active Divisions of the Department, besides the Administrative Division, as compared with the eight of which it is now comprised. As various features were added to the scope of the Department, it became necessary for the program of this Division to be extended.

A careful and detailed study has been made of the work of each Division in order that their purposes and operations might be understood. Consequently, the efforts of this Division have been directed in full coöperation with the personnel of other Divisions to the end that the objects of each might be advanced.

Realizing from the first that in order for the public to appreciate the benefits that would derive to all of the people from a well directed program of conservation and development and for the purpose of gaining the fullest measure of coöperation, the first objective of this Division has been to acquaint the citizenship of the State with the need of such a work.

Therefore, one of the major operations of this Department has been through the daily and weekly press of the State. It was deemed the better policy to carry on a sustained series of preferably short articles, covering one angle at the time. A continuous stream of news articles has been prepared for the press, being distributed through the Associated Press, the International News Service, the North Carolina Association of Afternoon Dailies, special correspondents, and directly from this office to the newspapers.

Special efforts have been made to present some important news feature with each article in order that the attention of the public might be drawn forcefully to the work being carried on by the Department and its significance to the general welfare. Very often the news releases have been suggestive of various means by which the public could coöperate and for the purpose of arousing more general interest in the topics referred to. By this means it has been sought to carry out an educational program centering around activities and objects of the Department.

During the biennium, some 573 articles have been distributed to the State and National press, combining news and educational phases within the State with advertising its resources nationally. While, no doubt, it would have been possible to have sent out additional articles to the press, it has been the object of the Division to maintain a suitable balance, preparing only those that it judged to have some sustaining news or educational value.

Department Publication

One of the most extensive and important features of the work of this Division has been the issuance of "Conservation and Industry", bi-monthly publication of the Department. The objectives of the booklet are varied. It serves the purpose of disseminating information to the field force of the Department,

including game, fish and forest wardens, stream gagers, and the rest of its personnel. It strives to promote increased enthusiasm for the work in which they are engaged and to offer suggestions by means of which the Department's program may be made more effective, and to arouse interest for other angles of conservation from that in which each individual is actively engaged.

Another important purpose being served by the publication is informing the public regarding the operations, the objectives, and opportunities offered by the conservation program.

A third purpose has been to advertise the resources and opportunities for development in North Carolina in other parts of the country.

Since the assumption of duties by the present manager of the Division, 41 issues of "Conservation and Industry" have been published. This has involved the writing and preparation of approximately 984 sheets of copy, reflecting work of all of the Divisions of the Department.

When the publication was resumed in the fall of 1926, it was in the form of a four-sheet folder. The title "Natural Resources" under which it has been issued for several years has been changed to "Conservation and Industry", and its size enlarged from a folder to a booklet containing an average of 14 pages, requiring approximately three times the amount of material for its publication.

Considerable time and effort have been spent in improving the effectiveness and scope of the mailing list of the publication. Upon resumption of the publication in 1926, its circulation consisted of some 2,500 to 2,800 names, many of which were returned because of changed addresses. Since that time the list has been completely revised by means of a circular in which it was ascertained the number who were interested in its contents and wished to continue to receive it.

As a result of this circular, some 500 names were dropped, and immediately steps were taken to rebuild the circulation on a more effective basis. The number of copies issued has now increased to 5,000 most of which reach persons who have requested to be included on the mailing list or for whom others have made application.

Persons interested in any phase of conservation and development have been offered an opportunity to receive the publication, and much of the material that is contained in it is clipped for wider use, thus bringing an appreciable amount of advertisement for the State and its natural and undeveloped resources.

Special Publications

"Fishing in North Carolina" and "Hunting in North Carolina" were issued during the biennium. Five thousand of the former and twenty thousand of the latter were the press runs for the two publications.

The bulletins were issued for a three-fold purpose; first, as a compilation of information and statistics treating the economic and recreational value of the two sports; second, to increase interest in these natural resources; and, third, to advertise facilities for recreation and sport. A section of the fishing publication was devoted to commercial fisheries.

Both of the Bulletins carry a volume of statistics already gathered but never published in pamphlet form and other information which was gathered especially for the purpose.

Their distribution has been broad, both in North Carolina and outside the State. Copies of each have been retained to meet requests as they are received by the Department.

Contemplated Publications

Considerable work has been done toward gathering materials to be used in a proposed pamphlet to be called "Where to Go and What to See in North Carolina". It is intended that this will be a travel guide, available both to residents of this State and outside tourists.

The plan for the publication calls for a State highway map in front on which various places of outstanding historic, scenic, recreational, industrial and other features would be located. These would be keyed with figures and letters giving a brief explanation of each special feature of interest and reference to space in the publication where a more elaborate description would be given.

An official of the State Highway Commission has intimated his interest in the proposed booklet with the probability that the Commission might coöperate in financing the publication. The Historical Commission has also extended an offer of assistance in compiling information. Officials of the Carolina Motor Club have also signified their willingness to coöperate in the preparation and distribution of the proposed booklet.

As the first step in the work, requests have already been made of all county historians to furnish material and suggestions. Already a number of these have replied.

Game Advertising

This Division has also undertaken a program for advertising hunting facilities and opportunities of the State. A series of advertisements is being prepared for National Sporting publications and others will follow. Reading matter as part of this campaign has also been furnished to various publications in this field.

Plans are being made to insert a series of advertisements during the middle of the hunting season in several of the large eastern and middle western daily newspapers. They will also be supplied with articles to supplement the paid advertisements.

General and Industrial Advertising

Advertising copy has been run in a number of large national and sectional publications for the purpose of exploiting tourist traffic and industrial opportunities in North Carolina. Advertisements have been run in the "National Investor", "Manufacturers Record", "Blue Book", and other publications.

Numerous articles run as free copy have been furnished to such publications as "Manufacturers Record", "Electrical America", "Electrical South", "Stone", "The Coal Age", "Black Diamond", "American Mining Congress Journal", "Engineering and Mining Journal", "Southern Fish and Oyster Reporter", "Field and Stream", "National Sportsman", "American Game Protective Association Bulletin", "Outdoor America", "Southern Lumberman", "Southern Lumber Journal", "National Investor", "New York Times", "Christian Science Monitor", "Pittsburgh Press" and others.

Photographs

With limited facilities, this Division has made a collection of photographs covering various fields of State advertising. These have been used by this and other Divisions in Department publications and have been distributed to publications in many parts of the country.

Photographs have been furnished to many agencies for illustrating prepared articles concerning the State. Special editions of North Carolina newspapers for the purpose of exploiting resources of the State have carried photographs furnished by this Division. Full pages of North Carolina pictures, obtained through this Division, have been run in large Eastern and Middle-Western newspapers and other periodicals.

Radio Broadcasting

This newest method of communication has not been neglected by the Department in promoting conservation and development of resources of the State.

Radio stations in North Carolina have been used in broadcasting conservation and development features, showing the present status of natural resources and offering suggestions to the public in regard to means of assisting in the State's official program dealing with these subjects.

During American Forest Week in April, 1928, a special series of radio addresses was given by the Division of Forestry and this Division. Special stress was laid in these talks on the protection of forest from fire and reforestation.

This Division is also assisting in the presentation of a series of radio talks scheduled to be given from WLAC at Nashville, Tenn., the latter part of October. The addresses will be given by heads of State Departments and leading industrialists. The progress and opportunities offered by the State will be stressed during this series.

Arrangements have been made with radio station WPTF at Raleigh for a regular weekly program of broadcasting. Other North Carolina stations have signified their willingness to coöperate and have offered the use of their facilities for this purpose.

Other Activities

Before the creation of the Division of Commerce and Industry the Division of Public Relations filled, to a limited degree, some of the functions which it took over. These included the tabulation of statistics regarding commerce, industry, and various phases of statistical work relating to the State.

It has also made numerous compilations for special articles in national magazines and for State newspapers. Frequent inquiries for information from colleges, schools, various agencies and individuals have been met.

FINANCIAL STATEMENT—CONSOLIDATED

RECEIPTS

State Appropriation.....	\$ 162,400.00
State Appropriation—Inland Fisheries.....	28,500.00
Refund on account of Sesquicentennial Exposition.....	1,768.41

Special Revenues:

Private coöperation	\$ 11,215.64
Federal Government—Forest Service.....	72,949.73
County Coöperation	28,283.66
Sale of Hunting Licenses	205,003.00
Sale of Fishing Licenses.....	27,355.75
Sale of Game.....	689.44
Sale of Seed and Seedlings.....	811.93
Sale of Publications.....	597.82
Elisha Mitchell Monument.....	340.75
Contributions by other State Departments for participation in Sesqui- centennial Exposition.....	4,637.73
Mt. Mitchell—concession.....	431.60
Transferred from Audubon Society.....	850.17
Refunds.....	3,711.67
Miscellaneous.....	427.72
	<hr/> \$ 357,306.61

Total all receipts..... \$ 549,975.02

DISBURSEMENTS

Personal Service.....	\$ 270,875.16
Supplies and Materials.....	21,615.12
Postage, Telephone and Express.....	14,412.77
Travel Expenses.....	38,201.94
Printing.....	13,793.70
Auto up-keep.....	7,298.90
Lights, gas and water.....	101.50
Repairs to equipment and buildings.....	4,194.15
General expenses.....	5,342.11
Equipment.....	28,122.84
Additions and Betterments.....	8,453.09
Purchase of Game.....	12,672.00
Expenses at State Game Farm and Refuges.....	16,736.79
Sesquicentennial Exposition.....	7,265.14
	<hr/> \$ 449,085.21

Balance On Hand..... \$ 100,889.81

This statement does not include receipts and disbursements of the Commercial Fisheries Division. See pages 60-64.

For financial statement by Divisions, see pages following report of each.

THE UNIVERSITY OF CHICAGO
LIBRARY
540 EAST 57TH STREET
CHICAGO, ILL. 60637

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